

The Tools of Asclepius

VISIT...

LANZAROTE
Caliente.COM

Studies in Ancient Medicine

Edited by

John Scarborough
Philip J. van der Eijk
Ann Ellis Hanson
Joseph Ziegler

VOLUME 43

The titles published in this series are listed at *brill.com/sam*

The Tools of Asclepius

*Surgical Instruments in Greek
and Roman Times*

By

Lawrence J. Bliquez



BRILL

LEIDEN | BOSTON

Cover illustration: Iapyx Treats Wounded Aeneas, House of Siricius, Pompeii. Drawing by Alexander Hollmann, after an image supplied by Patrick Hunt.

Library of Congress Cataloging-in-Publication Data

Bliquez, Lawrence J., author.

The tools of Asclepius : surgical instruments in Greek and Roman times / by Lawrence J. Bliquez.
p. ; cm. — (Studies in ancient medicine, ISSN 0925-1421 ; volume 43)

Includes bibliographical references and index.

ISBN 978-90-04-27907-0 (hardback : alk. paper) — ISBN 978-90-04-28359-6 (e-book)

1. Title. II. Series: Studies in ancient medicine ; v. 43. 0925-1421

[DNLN: 1. Surgical Instruments—history—Greek World. 2. Surgical Instruments—history—Roman World.

3. General Surgery—history—Greek World. 4. General Surgery—history—Roman World. 5. History, Ancient—Greek World. 6. History, Ancient—Roman World. W1 ST918K v. 43 2014 / WO 11.1]

RD71

617.0028'4—dc23

2014032771

This publication has been typeset in the multilingual 'Brill' typeface. With over 5,100 characters covering Latin, IPA, Greek, and Cyrillic, this typeface is especially suitable for use in the humanities.
For more information, please see brill.com/brill-typeface.

ISSN 0925-1421

ISBN 978-90-04-27907-0 (hardback)

ISBN 978-90-04-28359-6 (e-book)

Copyright 2015 by Koninklijke Brill NV, Leiden, The Netherlands.

Koninklijke Brill NV incorporates the imprints Brill, Brill Nijhoff and Hotei Publishing.

All rights reserved. No part of this publication may be reproduced, translated, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission from the publisher.

Authorization to photocopy items for internal or personal use is granted by Koninklijke Brill NV provided that the appropriate fees are paid directly to The Copyright Clearance Center, 222 Rosewood Drive, Suite 910, Danvers, MA 01923, USA. Fees are subject to change.

This book is printed on acid-free paper.

Alla cara memoria di Dionigio Magnani



Contents

Preface	ix
Sources	xii
Abbreviations, Short Titles	xii
Primary Sources and Translations	xiii
Traditional Latin Titles of Greek Works and Their Short Titles in English	xxiv
List of Figures	xxviii
Acknowledgements and Permissions for Figures	xxxiii

1 Introduction	1
The Study of the Instruments in Modern Times	1
Earlier Work on the Instruments	2
Emphasis on Nomenclature	6
Surgeons: Training and Practice	8
Design and Manufacture of Tools	14
Material, Characteristics, and Quality of Tools and Paraphernalia	16
How Successful were the Surgeries?	20
2 Hippocratic Surgeries and Surgical Tools	23
Cupping Vessels	25
Cutting and Puncturing Instruments	27
Cauteries	30
Probes	33
Bone and Tooth Instruments	38
Forceps, Retractors	40
Gynecological Tools	42
Tubes	45
Speculum?	48
'Hippocratic' Survivals	50
3 The Hellenistic Contribution	51
4 Tools of the Empire	56
Cupping Vessels	56
Cutting and Puncturing Instruments	72
Probes (Including Spatulas and Spoons)	108
Needles	147
Cauteries	157

Retractors and Hooks	173
Bone and Tooth Instruments	183
Tubes	207
Forceps	233
Gynecological and Obstetrical Instruments	249
Miscellaneous Parasurgical Items	262
Vessels/Containers	273
 Appendix: Materials, Sutures, Plugs, 'Tents', etc.	 299
Postscript	348
Bibliography	349
General Index	366
Greek Index	374
Latin Index	378
Figures	381

Preface

This book is intended to replace John Stuart Milne's *Surgical Instruments in Greek and Roman Times*, the classic on the subject in English since 1907 (reprinted 1970). It has been gestating, on and off, for perhaps fifteen years, as one distraction or another required my attention. My retirement four years ago has allowed me to bring it to a conclusion.

Those of us interested in the archaeological aspects of Greco-Roman medicine have long known that Milne was outdated and that a new treatment of the tools was needed. As best I can remember Ralph Jackson suggested I undertake the project, and its completion owes a great deal to him and to Ernst Künzl for advice and support constantly and generously given over the years.¹ I thank too Klaus-Dietrich Fischer and Antje Krug for keeping me abreast of their work and for supplying needed information. Additional help, gratefully received, has been provided by Jerome Kohl, master digitalizer, by Alexander Hollmann, who produced necessary last minute drawings, by the anonymous referee for Brill, who supplied bibliography I might otherwise have neglected, by Professor Daniş Baykan (University of Trakya, Edirne), who sent on a copy of his recent work at Alliano, by Sanchita Balachandran, who arranged for fresh images of the Colophon instruments and by Alain Gowing for constant technical advice.² I am especially indebted to John Scarborough for his constant encouragement and guidance, not just for this, but for other undertakings I have attempted that focused on Greco-Roman surgical tools. In thanking these scholars and friends for their input I am, of course, not associating them in any way with shortcomings and mistakes that I have undoubtedly made and for which I alone am responsible.

I envy Milne for his experience as a physician and surgeon, which I am decidedly not. On the other hand the amount of medical knowledge required for an exercise of the present type is not extensive if one stays concentrated

1 The spate of references made herein to the works of these two gentlemen is clear indication of my indebtedness, if such be needed.

2 I am also grateful to the following individuals who, in various ways, have been of assistance in the preparation of this volume: Johannes Laurentius, Berlin (GER.); Angelika Rau and Lothar Altringer, both Bonn (GER.); Susan Turner, Cambridge (UK); Marion Ruisinger, Ingolstadt (GER.); Andreas Christoph, Jena (GER.); Peter Jan Bomhof, Leiden (NL); Ann Ellis Hanson, New Haven (CT./USA); Demetrios Michaelides, Nicosia (CYPRUS); Marie-Véronique Clin, Paris (FR.); Hélène Chew, Saint-Germaine en Laye (FR.); Patrick Hunt, Palo Alto (Ca./USA); Artemis Antipas, Scott Noegel, and Catherine Connors, all Seattle (Wa./USA).

on the instruments, as I have tried to do, and does not become too involved with the details (or the lack thereof, which then have to be conjectured) of complex operations as recorded in the sources. For the same reason I have not dealt much with the distinctions to be made between Greek and Latin terms for a disease or a surgical procedure which also circulate in modern English: e.g. *gastrorrhaphia*. In such cases I have mostly been content to use the ancient name and leave it at that.

On the other hand, I have enjoyed the advantage over Milne of having a corpus of authenticated instruments from graves and sites supplied by the work of Künzl, Jackson and, in some small measure, myself.³ This material has served as a typological guide for genuine tools that Milne did not have (see following Introduction). Another advantage Milne did not enjoy was the ease with which one can now collect and study electronically most relevant texts by running searches of appropriate terms through the *Thesaurus Linguae Graecae* and its complementary production, the *Thesaurus Linguae Latinae*. These resources also allowed me to conveniently isolate and include many references to instruments occurring in Greek veterinary tracts, material on which Milne did not concentrate.⁴

The term 'Tools' in my title covers a great deal of ground, rather more than I could cope with. On that account, like Milne, I do not deal with devices, such as ladders and specially constructed 'beds', etc. used as instruments of reduction (*organikoi*). I confess to being a poor mechanic; that fact, and the necessity of bringing this study to a completion after so long a time, necessitated the elimination from consideration of what one might call healing machines, quite complex in many cases. Most likely they were constructed on the spot for particular cases, and one can only wonder how often the more involved devices were actually brought into play.⁵

Another subject that I have shortchanged, as did Milne, is names and descriptions of the bandaging arrangements that occur in classical sources. A perusal of Oribasius alone demonstrates graphically that for me to have done so would have required a good deal of time and effort on a subject that, like complex machines for reduction, really requires an independent monograph.

On the other hand, I have tried to include a reasonable amount of information on parasurgical equipment, such as mortars, pestles and pots and con-

3 I think here especially of Künzl (1983a); Jackson (2003, 2009b) and Bliquez, Jackson (1994). I myself had been taken in by forgeries before 1983 (see my contrite recantation [1986]).

4 For much of the Latin terminology I have benefited from a list generously shared with me by Klaus-Dietrich Fischer.

5 See Humphrey, Oleson, Sherwood (1998) 54–55.

tainers to prepare and store medicines. Milne had in fact treated this category, though in much smaller measure, as he did not have access to the grave finds assembled by Künzl. These greatly expanded the amount of such material we could be sure was associated with medicine, thus prompting me to say more about it. I also carried much further Milne's treatment of natural products: wood, sponge, wool and linen. As these items were surely available to and necessary for physicians on a constant basis, they have been discussed in a lengthy appendix (Materials, Sutures, Plugs, 'Tents', etc.).

In sum, the focus here is on the everyday tools of the trade and parasurgical gear kept in the clinic or carried on the road.

Finally, as Milne, I have made an effort to transliterate Greek names for the instruments and for some other terms, many of which do not make their way into contemporary English.

Sources

Abbreviations, Short Titles

- BGM: Paul Burguière, Danielle Gourevitch, Yves Malinas, ed., trans., comm., *Soranos d'Éphèse, Maladies des femmes*, 4 vols. (Paris: Les belles lettres, 1988–2000 [Budé series]);
- Gar = *Galenus, Anatomicarum administrationum libri qui supersunt novem: earundem interpretatio Arabica Hunaino Isaaci filio ascripta*, ed. Ivan Garofalo, 2 vols., (Neapoli: Prostat apud E.J. Brill, Lugduni Batavorum, 1986–2000);
- Herm. Mon. = *Hermeneumata Monacensia*: in *Corpus glossariorum latinorum, a Gustavo Loewe incohaturum, auspiciis Academiae litterarum saxonicae composuit recensuit edidit Georgius Goetz* (Lipsiae, Berolini: in aedibus B.G. Teubneri), vol. 3 (1892) 207–208;
- Hippiat. Ber., Cantabrig., etc. = *Corpus Hippiatricorum Graecorum*, ed. Eugene Oder, K. Hoppe, 2 vols. (Leipzig: Teubner, 1924; repr. Stuttgart 1971);
- Hirschberg, Waugh = *Die Augenheilkunde des Aëtius aus Amida; Griechisch und Deutsch*, ed. Julius Hirschberg (Leipzig: Veit, 1899). Republished as *The Ophthalmology of Aëtius of Amida Translated Into English, Commented, Enlarged and Illustrated by Richey L. Waugh* (Oostende: J.P. Wayenborgh, 2000 [The Monographs, vol. 8]). [N.B. Hirschberg's text is limited to chapters 1–90 of Aëtius 7].
- J-H = Ian Johnston, G.H.R. Horsley, ed., trans., *Galen, Method of Medicine*, 3 vols. (Cambridge, Mass, London: Harvard U. Press, 2011);
- K = Carl G. Kühn, ed., *Claudii Galeni Opera omnia*, 20 vols. in 22 parts (Leipzig: 1821–1833); revised by K. Schubring (Hildesheim: G. Olms, 1964–65);
- L = É. Littré, ed., comm., *Oeuvres complètes d'Hippocrate: traduction nouvelle avec le texte grec en regard, collationné sur les manuscrits et toutes les éditions, etc.* (Paris: Baillière 1839–1861; repr. Amsterdam: A.M. Hakkert, 1961–1962);
- Lists = Medieval Lists (see below, Primary Sources and Translations);
- LSJ = Henry George Liddell and Robert Scott, rev. Henry Stuart Jones, *A Greek-English Lexicon*, 9th ed., with a revised supplement (Oxford: Clarendon Press, 1996);
- P = Paul Potter, ed. & trans., *Hippocrates*, Loeb Classical Library edition, vols. 5–6, 8–10 (Cambridge, Mass.: Harvard Univ. Press, 1988, 1995, 2010, 2012);
- Petit = Caroline Petit, ed., trans., comm., *Galien, Tome III: Le médecin. Introduction* (Paris: Les Belles Lettres, 2009 [Budé series]);

PG: Patrologiae cursus completus. Series Graeca, 166 vols., ed. J.-P. Migne (Paris: Garnier, 1857–1891); specifically vol. 31;

Ser = Guy Serbat, ed., trans., comm., *Celse, De la médecine*, Livres I–II (Paris: Les Belles Lettres, 1995– [Budé series]);

TLG = *Thesaurus Linguae Graecae* (CD-ROM, version D).

Primary Sources and Translations⁶

Aelius Herodianus & Pseudo-Herodianus

Herodiani partitiones, ed. J.F. Boissonade (London 1819; repr. Amsterdam: Hakkert, 1963) 1–282.

Aesopica

Corpus Fabularum Aesopicarum, ed. A. Hausrath and H. Hunger, vols. 1.1 and 2.1, 2nd ed. (Leipzig: Teubner, 1970).

Aëtius of Amida

(N.B.: I follow the line numbers given in the *TLG*)

Aetii medici contractae ex veteribus medicinae tetrabiblos, hoc est quaternio, id est libri universales quatuor, singuli quatuor sermones complectentes, ut sint in summa quatuor sermonum quaterniones, id est sermones XVI per Janum Cornarium... Latine conscripti. (Basileae: Impensis H. Frobenii & N. Episcopii, 1542);

Aetii amideni libri medicinales i–iv, ed. A. Oliveri (Leipzig and Berlin: Teubner, 1935) = *Corpus Medicorum Graecorum*, vol. 8.1;

Aetii amideni libri medicinales v–viii, ed. A. Oliveri (Berlin: Akademie-Verlag, 1950) = *Corpus Medicorum Graecorum*, vol. 8.2;

Die Augenheilkunde des Aëtius aus Amida; Griechisch und Deutsch, ed. Julius Hirschberg (Leipzig: Veit, 1899). Republished as *The Ophthalmology of Aëtius of Amida* Translated into English, Commented, Enlarged and Illustrated by Richey L. Waugh (Oostende: J.P. Wayenborgh, 2000 [The Monographs, vol. 8]);

Ἀετίου Ἀμιδηνοῦ λόγος ἑνατος [= Aëtius IX], ed. S. Zervos, *Athena* 23 (1911) 273–390 [accessed *TLG*];

⁶ The literary testimonia underlying this handbook have been extracted or summarized from the following authors. They are listed in alphabetical order, each accompanied by a list of works cited. For a convenient source of up to date information about each of the medical writers the reader may consult Keyser and Irby-Massie (2008).

- For Aëtius XI see Rufus of Ephesus below;
- Ἀετίου λόγος δωδέκατος [= Aëtius XII], ed. G.A. Kostomiris (Paris: Klincksieck, 1892) [accessed *TLG*];
- S. Zervos, Ἀετίου Ἀμιδηνοῦ λόγος περὶ δακνόντων ζώων καὶ ἰοβόλων [= Aëtius XIII], *Athena* 18 (1906) 264–292 [accessed *TLG*];
- Ἀετίου Ἀμιδηνοῦ λόγος δέκατος πέμπτος [= Aëtius XV], ed. S. Zervos, *Athena* 21 (1909) 7–138 [accessed *TLG*];
- Gynaekologie des Aetios sive sermo sextus decimus et ultimus: zum erstenmale aus Handschriften veröffentlicht* [= Aëtius XVI], ed. Skevos Zervos (Leipzig: Fock, 1901) [accessed *TLG*];
- Aetios of Amida, *The Gynaecology and Obstetrics of the VIIth Century, A.D.* [= Aëtius XVI]. Translated from the Latin Edition of Cornarius, 1542, and Fully Annotated by James V. Ricci (Philadelphia and Toronto: Blakiston Co., 1950).

Albucasis

- Albucasis on Surgery and Instruments*, ed. [Arabic], trans., comm. M.S. Spink and G.L. Lewis (Berkeley and Los Angeles: U. of California, 1973).

Alexander of Aphrodisias

- Problemata*: in *Physici et Medici Graeci Minores*, ed. I.L. Ideler, 2. vols. (Berlin, 1841–1842; repr. in one volume, Amsterdam: A. Hakkert, 1963) vol. 1, 3–80.

Alexander of Tralles

- Alexander von Tralles: Original-Text und Übersetzung nebst einer einleitenden Abhandlung. Ein Beitrag zur Geschichte der Medicin*, ed., trans. Theodor Puschmann (Vienna: Wilhelm Braunmüller, 1878–1879; 2 vols.; repr. Amsterdam: A.M. Hakkert, 1963).

Anonymi Medici

- R. Fuchs, “Aus Themisons Werk über die acuten und chronischen Krankheiten,” *Rheinisches Museum*, 58 (1903) 67–114.
- Anonymi Medici. De morbis acutis et chroniis*, ed., comm. Ivan Garofalo, translated by Brian Fuchs (Leiden: E.J. Brill, 1997 [Studies in Ancient Medicine, no. 12]).

Archigenes of Apamea

- “Frammenti inediti di Archigene,” ed. G.L. Calabrò, *Bollettino del comitato per la preparazione della edizione nazionale dei classici greci e latini* 9 (1961) 68–72.

Aretaeus of Cappadocia

Aretaeus, ed. Carolus Hude (Leipzig and Berlin: Teubner, 1923; 2nd ed. Berlin: Akademie Verlag, 1958) = *Corpus Medicorum Graecorum* 2.

Aristophanes of Byzantium

Aristophanis Byzantii Fragmenta, ed. William J. Slater (Berlin and New York: Walter de Gruyter, 1986).

Athenaeus of Naucratis

Athenaeus, The Deipnosophists, tr. Charles Burton Gulick, Loeb Classical Library edition, 7 vols. (Cambridge, Mass: Harvard University Press; London: W. Heinemann, 1927–1941), esp. vols. 2 (1928, repr. 1957), 5 (1933, repr. 1955) and 6 (1937).

Caelius Aurelianus

On Acute Diseases and On Chronic Diseases, ed., trans. I.E. Drabkin (Chicago: U. of Chicago Press, 1950).

Cassius Felix

Cassius Felix. De la médecine, ed., trans., comm. Anne Fraisse (Paris: Les Belles Lettres, 2002 [Budé series]); [All citations from Fraisse unless otherwise noted.]

Cassii Felicis de Medicina, ed. Valentin Rose (Lipsiae: in Aedibus B.G. Teubneri, 1879).

Celsus (A. Cornelius Celsus)

A. Cornelii Celsi quae supersunt, ed. F. Marx (Lipsiae, Berolini: in aedibus B.G. Teubneri, 1915) = *Corpus Medicorum Latinorum*, vol. 1; [All citations from Marx unless otherwise noted.]

Celse de la médecine, Livres I–II, ed., trans., comm. Guy Serbat (Paris: Les Belles Lettres, 1995– [Budé series]);

Celsus: De Medicina, Loeb Classical Library edition, 3 vols., trans. W.G. Spencer, (Cambridge, Mass.: Harvard University Press; London: Heinemann, 1935–1938);

For the Toledo Supplement see: D. Ollero Granados, “Dos nuevos capítulos de A. Cornelio Celso,” *Emerita* 41 (1973) 99–108; and U. Capitani, “Il recupero di un passo di Celso in un codice del ‘De medicina’ conservato a Toledo,” *Maia* 26 (1974) 161–212.

Diocles of Carystus

Diocles of Carystus: a collection of the fragments with translation and commentary, 2 vols., Philip J. van der Eijk (Leiden, Boston, Cologne: Brill, 2000–2001 [Studies in Ancient Medicine 22–23]).

Dioscorides of Anazarbus

Pedanii Dioscoridis Anazarbei de materia medica libri quinque, 3 vols., ed. Max Wellmann (Berolini, Apud Weidmannos, 1906–1914; repr. of latter 1958); John Scarborough and Vivian Nutton, “The Preface of Dioscorides *Materia Medica*: Introduction, Translation, Commentary,” *Transactions and Studies of the College of Physicians of Philadelphia*, 4 (1982), 187–227; *Pedanius Dioscorides of Anazarbus De materia medica*, trans. Lily Y. Beck [from the Wellmann ed.] (Hildesheim, Zürich, and New York: Olms-Weidmann, 2005; 2nd rev. & augm. ed., 2011).

[*Dioscorides*]

Euporista vel De simplicibus medicinis, ed. Max Wellmann, = vol. 3 of *Pedanii Dioscoridis Anazarbei de materia medica libri quinque* [I bracket here and throughout in keeping with doubts as to authorship; see Wellmann (1914) and *RE* V.1 (1903) col. 1131–42, s.v. “Dioskurides (12).”].

Pseudo-Dioscorides

[*Pedanii Dioscoridis Anazarbei*], *De iis, quae virus ejaculantur, animalibus libellus, in quo et de rabioso cane (= Theriaca)*, ed., trans. [Latin] K. Sprengel, [in] C.G. Kühn, ed., *Medicorum Graecorum Opera*, vol. 26.2 (Leipzig: Knobloch, 1830) 42–91.

Epiphanius of Salamis

E.D. Moutsoulas, ed., “Epiphanius of Salamis, Concerning Weights and Measures, Introduction, Commentary, Text, and Notes,” *Theologia*, 44 (1973) 157–198.

Erotian

E. Nachmanson, *Erotiani vocum Hippocraticarum collectio cum fragmentis* (Göteborg: *Eranos*, 1918) 3–96: referred to herein as Erotian, *Hippocratic Glossary*.

Eustathius

Eustathii archiepiscopi Thessalonicensis commentarii ad Homeri Iliadem pertinentes, ed. M. van der Valk, 4 vols. (Leiden: Brill, 1971–1987);

Eustathii archiepiscopi Thessalonicensis commentarii ad Homeri Odysseam, ed. G. Stallbaum, 2 vols. in 1 (Leipzig: Weigel, 1825, 1826; repr. Hildesheim: Olms, 1970).

Galen of Pergamon

Claudii Galeni, Opera omnia, ed. C.G. Kühn, 20 vols. in 22 parts (Leipzig: Cnobloch, 1821–1833; repr. Hildesheim: Georg Olms, 1964–1965) in *Medicorum Graecorum Opera Quae Exstant*; [Citations in Greek from Kühn unless otherwise indicated.];

(Selected Works)

Galen, on the parts of medicine; on cohesive causes; on regimen in acute diseases in accordance with the theories of Hippocrates, Arabic version, ed., trans. Malcom Lyons, with reedited Latin versions of *on the parts of medicine* and *on cohesive causes* by J. Kollesch, D. Nickel, and G. Strohmaier (Berlin: Akademie-Verlag, 1969) = *Corpus Medicorum Graecorum. Supplementum Orientale*, 2;

Galen, Selected works; trans. with introduction and notes by P.N. Singer (Oxford [England]; New York: Oxford University Press, 1997); [Provides a full translation of *Thrasybulus, Is Health Part of Medicine or Gymnastics?* and *On my/his own Books*];

Galen: Psychological Writings ed. P.N. Singer (Cambridge and New York: Cambridge Univ. Press, 2013), [Provides a full translation of recently recovered *Avoiding Distress* by Vivian Nutton];

Galien, Sur ses propres livres [in] *Galien*, vol. 1: *Introduction général. Sur l'ordre des ses propres livres. Sur ses propres livres. Que l'excellent médecin est aussi philosophe*, Véronique Boudon-Millot, ed., trans., comm. (Paris: Les Belles Lettres, 2007 [Budé series]);

(The Following Individual Works are Listed Roughly in Alphabetical Order of Title)

Galen On Anatomical Procedures, trans. Charles Singer (London, New York: Oxford University Press, 1956);

Galen On Anatomical Procedures. The Later Books, trans. W.L.H. Duckworth [from the German, trans., ed., from Arabic by Max Simon (1906), ed. and checked against the Arabic text by M.C. Lyons, and ed. (anatomy) by B. Towers] (Cambridge: Cambridge University Press, 1962);

Galenus, Anatomicarum administrationum libri qui supersunt novem: earundem interpretatio Arabica Hunaino Isaaci filio ascripta, ed. Ivan Garofalo, 2 vols., (Neapoli: Prostat apud E.J. Brill, Lugduni Batavorum, 1986–2000);

- Galien, Art médical* [in] *Galien*, vol. 2: *Exhortation à l'étude de la médecine. Art médical*, Véronique Boudon, ed., trans., comm. (Paris: Les Belles Lettres, 2002 [Budé series]);
- Galen on Bloodletting: A Study of the Origins, Development and Validity of his Opinions, with a Translation of the Three Works* by Peter Brain (Cambridge and New York: Cambridge U. Press, 1986);
- Galen, On the Doctrines of Hippocrates and Plato*, 3 vols., ed., trans., comm. Phillip De Lacy (Berlin: Akademie Verlag, 1978–1984) = *Corpus Medicorum Graecorum* V 4, 1, 2;
- Galen, On Examinations by which the Best Physicians are Recognized (De optimo medico cognoscendo)*, Arabic version, ed., trans., comm. A.Z. Iskandar (Berlin: Akademie Verlag, 1988) = *Corpus Medicorum Graecorum, Supp. Orient.* 4;
- Galen in Hippocratis epidemiarum librum i commentaria iii*, ed. E. Wenkebach (Leipzig, Teubner, 1934) = *Corpus Medicorum Graecorum* 5.10.1;
- Galen in Hippocratis epidemiarum librum iii commentaria iii*, ed. E. Wenkebach (Leipzig, Teubner, 1936) = *Corpus Medicorum Graecorum* 5.10.2.1;
- Galen in Hippocratis epidemiarum librum vi commentaria i–vi*, ed. E. Wenkebach, (Leipzig: Teubner, 1940) = *Corpus Medicorum Graecorum* 5.10.2.2, 3–351;
- Galen, In Hippocratis De officina medici commentariorum, etc.*, Arabic version, ed., trans. Malcom Lyons (Berlin: Akademie Verlag, 1963) = *Corpus Medicorum Graecorum, Supp. Orient.* 1;
- Galen, Method of Medicine*, ed., trans. Ian Johnston, G.H.R. Horsley, 3 vols. (Cambridge, Mass., London; Harvard U. Press, 2011 [Loeb Classical Library]);
- Galien, Ne pas se chagriner*, ed., trans. Véronique Boudon-Millot, Jacques Jouanna, with collaboration of Antoine Pietrobelli, *Galien*, vol. 4 (Paris: Les Belles Lettres, 2010 [Budé series]);
- Galen in Platonis Timaeum commentarii fragmenta*, ed. H.O. Schröder (Leipzig: Teubner, 1934) = *Corpus medicorum Graecorum, supplementum, vol. 1*;
- Galen, On Prognosis*, ed., trans., comm. Vivian Nutton (Berlin: Akademie Verlag, 1979) = *Corpus Medicorum Graecorum* 5.8.1;
- Galen, On the Usefulness of the Parts of the Body*, 2 vols., trans., comm. Margaret T. May (Cornell U. Press: Ithaca, 1968).

Pseudo Galen

- Galien, Le Médecin. Introduction*, ed. trans. Caroline Petit, *Galien*, vol. 3 (Paris: Les belles lettres, 2009 [Budé series]).

Hagiographical Sources

Vie et miracles de Sainte Thècle, Text Grec, Traduction et Commentaire by G. Dagron (Brussels: Subsidia Hagiographica, 62, 1978).

Heron of Alexandria

Heronis Alexandrini, Opera quae supersunt omnia, ed. W. Schmidt, L. Nix, H. Schöne, J.L. Heiberg, 5 vols. (Leipzig: Teubner, 1899–1914).

Herophilus of Chalcedon

Herophilus: the art of medicine in early Alexandria, ed., trans. H. von Staden (Cambridge; New York: Cambridge University Press, 1989).

Hippiatrica

Corpus Hippiatricorum Graecorum, ed. Eugene Oder and K. Hoppe, 2 vols. (Leipzig: Teubner, 1924–1927; repr. Stuttgart 1971); vol. 1: *Hippiatrica Berolinensia*; vol. 2: *Hippiatrica Parisina. Cantabrigiensia. Londinensia. Lugdunensia. Appendix.*

[*Hippocrates*]

Oeuvres complètes d'Hippocrate, traduction nouvelle avec le texte grec en regard, collationné sur les manuscrits et toutes les éditions; accompagnée d'une introduction, de commentaires médicaux, de variantes et de notes philologiques: suivie d'une table générale des matières, Par É. Littré, 10 vols. (Paris: Baillière, 1839–1861; repr. Amsterdam: A.M. Hakkert, 1961–1962); [Citations from Littré unless otherwise noted.]

Hippocrates de dieta, ed., trans. [French], and comm. R. Joly, with coll. Simon Byl (Berlin: Akademie, 2003) = *Corpus Medicorum Graecorum* 1.2.5;

Hippocrates, On head wounds, ed., trans., and comm. Maury Hanson (Berlin: Akademie Verlag, 1999) = *Corpus Medicorum Graecorum* 1.4.1;

Hippocrates, Loeb Classical Library edition, 10 vols., ed., trans.: W.H.S. Jones [vols. 1, 2, 4], E.T. Withington [vol. 3], Paul Potter [vols. 5, 6, 8–10], Wesley D. Smith [vol. 7], (Cambridge, Mass.: Harvard Univ. Press, 1988–2010).

Leon Iatrosophistes

Leon Iatrosophistes, *Conspectus Medicinae* (= *Synopsis of Medicine*) in F.Z. Ermerins, ed., *Anecdota medica Graeca* (Leiden, 1840; repr. Amsterdam: A.M. Hakkert, 1963) 79–217.

Medieval Lists

- H. Schöne, "Zwei Listen chirurgischer Instrumente," *Hermes* 38: 280–284;
 Lawrence J. Bliquez, "Two Lists of Greek Surgical Instruments and the State of Surgery in Byzantine Times," *Dumbarton Oaks Papers*, 38 (1984) 187–204;
 K.-D. Fischer, "'Universorum Ferramentorum Nomina': Frühmittelalterliche Listen chirurgischer Instrumente und ihr griechisches Vorbild," *Mittelalterinisches Jahrbuch*, 22 (1987) 28–44.

Marcellus Empiricus (Marcellus of Bordeaux)

- Marcelli de Medicamentis Liber*, *Marcellus über Heilmittel*, ed. M. Niedermann, E. Liechtenhan; trans. J. Kollesch and D. Nickel (Akademie Verlag; Berlin, 1968) = *Corpus Medicorum Latinorum* v.

Mulomedicina Chironis

- Claudii Hermeri Mulomedicina Chironis*, ed. Eugenius Oder (Leipzig: Teubner, 1901).

Muscio (See under Soranus)

Nicander of Colophon

- Nicander of Colophon, Poems and poetical fragments*, ed., trans., comm. A.S.F. Gow, A.F. Scholfield (Cambridge: Cambridge University Press, 1953);
Scholia in Nicandri Alexipharmaca cum glossis, ed., Marius Geymonat (Milan: Cisalpino, 1974);
Scholia in Nicandri Theriaca, ed. Annunziata Crugnola (Milan: Cisalpino, 1971).

Oribasius of Pergamon

- J. Raeder (ed.) *Oribasii Collectionum medicarum reliquiae*, 5 vols. (Lipsiae et Berolini in Aedibus B.G. Teubner, 1928–1933) = *Corpus Medicorum Graecorum* 6.1–2; *Synopsis ad Eustathium, Libri ad Eunapium* (1926) = *Corpus Medicorum Graecorum* 6.3.

Paul of Aegina

- Francis Adams, *The seven books of Paulus Aegineta. Translated from the Greek. With a commentary embracing a complete view of the knowledge possessed by the Greeks, Romans, and Arabians on all subjects connected with medicine and surgery*, 3 vols. (London, Printed for the Sydenham Society, 1844–1847);
Chirurgie de Paul d'Egine, ed., trans. (of book six) R. Briau (Paris: V. Masson, 1855);

Paulus Aegineta: Epitomae medicae libri septem, ed. J.L. Heiberg, 2 vols. (Leipzig and Berlin: Teubner, 1921, 1924) = *Corpus Medicorum Graecorum*, vols. 9.1 and 9.2. [All citations from Heiberg unless otherwise noted].

Pelagonius

Pelagonii Ars Veterinaria, ed. Klaus-Dietrich Fischer (Leipzig: Teubner, 1980).

Philumenus

Philumeni de venenatis animalibus eorumque remediis, ed. M. Wellmann (Leipzig: Teubner, 1908) = *Corpus Medicorum Graecorum* 10.1.1.

Photius

Photius, *Bibliothèque*, ed., trans. R. Henry, 8 vols. (Paris: Les Belles Lettres, 1959–1977 [Budé series]).

Physici et Medici Graeci Minores

Physici et Medici Graeci Minores, ed. I.L. Ideler, 2 vols. (Berlin, 1841–1842; repr. as one vol. Amsterdam: A.M. Hakkert, 1963).

Pliny (Gaius Plinius Secundus)

Pliny, Natural History, Loeb Classical Library, 10 vols., ed., trans. H. Rackham, W.H.S. Jones, D. Eichholz (London: Heinemann; Cambridge: Harvard, 1938–1963).

Pliny 'Medicus'

Physica Plinii Bambergensis (Cod. Bamb. med. 2, fol. 93^v–232^r), ed. Alf Önnersfors (Hildesheim and New York: G. Olms, 1975).

Poetae Comici Graeci

Poetae Comici Graeci, eds. Rudolph Kassel, Colin Austin (Berlin and New York, Walter de Gruyter, 1983–).

Porphyrius of Tyre

Porphyrii quaestionum Homericarum ad Iliadem pertinentum reliquae, ed. H. Schrader, 2 fasc. (Leipzig: Teubner, fasc. 1 [1–180] 1880, fasc. 2 [183–278] 1882).

Priscian

Theodori Prisciani Euporiston Libri III, ed. V. Rose (Leipzig: Teubner, 1894).

Psellus

Michaelis Pselli Poemata, ed. L.G. Westerink (Leipzig and Stuttgart: Teubner, 1992) [*De medicina*, pp. 190–233].

Rufus of Ephesus

Oeuvres de Rufus d'Éphèse, texte collationné sur les manuscrits, traduit pour la première fois en français, avec une introduction, ed., trans. Ch. Daremberg, Ch. Émile Ruelle (Paris: Impr. Nationale, 1879; repr. Amsterdam: Hakkert, 1963). [Taken from Aëtius XI];

Scribonius Largus

Scribonius Largus, *Compositiones*, ed. S. Sconocchia (Leipzig: Teubner, 1983).

Severus Iatrosophistes

De instrumentis infusoriis seu chysteribus ad Timotheum, ed. F.R. Dietz, *Severi iatrosophistae de chysteribus liber* (Diss. med., Königsberg, 1836).

Soranus of Ephesus

Soranos d'Éphèse, Maladies des femmes, texte établi, traduit et commenté par Paul Burguière, Danielle Gourevitch, Yves Malinas, 4 vols. (Paris: Les belles lettres, 1988–2000 [Budé series]); [All citations from Burguière, Gourevitch, and Malinas, unless otherwise noted.];

Sorani Gynaeciorum libri iv, de signis fracturarum, de fasciis, vita Hippocratis secundum Soranum, ed. J. Ilberg (Leipzig: Teubner, 1927) = *Corpus Medicorum Graecorum* 4;

Soranus' Gynecology, trans. Owsei Temkin with assistance of N.J. Eastman, L. Edelstein, and A.F. Guttmacher (Baltimore: Johns Hopkins, 1956);

Sorani Gynaeciorum Vetus Translatio Latina, Nunc Primum Edita Cum Additis Graeci Textus Reliquiis A Diezio Repertis Atque Ad Ipsum Codicem Parisiensem Nunc Recognotis A Valentino Rose (Leipzig: Teubner, 1882) = Muscio.

Stephanus of Athens

Stephanus the Philosopher and Physician, Commentary on Galen's Therapeutics to Glaucon, ed., trans. Keith Dickson (Leiden, Boston, Köln: Brill, 1998; repr. Amsterdam: A.M. Hakkert) = *Studies in Ancient Medicine* 19;

Stephanus the Philosopher, A Commentary on the Prognosticon of Hippocrates, ed. trans. John Duffy (Berlin: Akademie-Verlag, 1983) = *Corpus Medicorum Graecorum* XI 1.2;

Stephanus of Athens, Commentary on Hippocrates' Aphorisms, ed. and trans. Leendert G. Westerink, 3 vols. (Berlin: Akademie-Verlag, 1985–1995) = *Corpus Medicorum Graecorum* XI 1.3.1–XI 1.3.3.

Stoics

Stoicorum veterum fragmenta, vol. 2, *Fragmenta logica et physica*, ed. J. Von Arnim, (Leipzig: Teubner, 1903).

Tertullian

Quinti Septimi Florentis Tertulliani De anima, ed., introd., comm. J.H. Waszink, (Amsterdam: J.M. Meulenhoff, 1947).

Themison

(*See above, Anonymi Medici*)

Theocritus

Scholia in Theocritum vetera, ed. C. Wendel (Leipzig and Berlin: Teubner, 1914; repr. Stuttgart: Teubner, 1967).

Theophilus Protospatharius

On the Structure of the Human Body, ed. with trans. [Latin] William A. Greenhill as *Theophili Protospatharii de corporis humani fabrica libri v* (Oxford: Clarendon Press, 1842 [e typographeo academico]);

Theophilus Protospatharius, Damascius et Stephanus Atheniensis, Commentarii in Hippocratis aphorismos, ed. F.R. Dietz, *Scholia in Hippocratem et Galenum*, vol. 2, 236–240, 244–544 (Königsberg: Borntraeger, 1834, repr. Amsterdam: Hakkert, 1966).

Typika

Typikon du monastère impérial du Pantocrator, ed. and trans. Paul Gautier = “Le Typikon du Christ Sauveur Pantocrator,” *Revue des Études byzantines*, 32 (1974), 1–145 (Greek text with French trans., 26–131);

“*Pantokrator: Typikon of Emperor John II Komnenos for the Monastery of Christ Pantokrator in Constantinople*,” trans. by Robert Jordan: in John Thomas and Angela Constantinides Hero, eds., *Byzantine Monastic Foundation Documents: A Complete Translation of the Surviving Founders' Typika and Testaments*, vol. 2 (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2000), pp. 725–781.

Vegetius

P. Vegeti Renati digestorum artis mulomedicinae libri, ed. Ernest Lommatzch (Leipzig: Teubner, 1903).

Zonaras

Joannes Zonaras, *Epitome historiarum*, ed. L. Dindorf, 6 vols. (Leipzig: Teubner, 1868–1875); *Libri 13–18*, ed. T. Büttner-Wobst (Bonn: Weber, 1897 [*Corpus Scriptorum Historiae Byzantinae*, vol. 42])).

Traditional Latin Titles of Greek Works and Their Short Titles in English

Aretaeus

Care Acut. Diseases = *De curatione acutororum morborum libri duo*;

Care Chron. Diseases = *De curatione diuturnorum morborum libri duo*;

Causes Signs Acute Diseases = *De causis et signis acutorum morborum* (lib. 2).

Dioscorides

Materials used in Medicine (*Mat. Med.*) = *De materia medica libri quinque*.

[*Dioscorides*]

Euporista or Simples = *Euporista vel De simplicibus medicinis*.

Galen

Anatomical Procedures (*Anat. Proc.*) = *De anatomicis administrationibus libri ix*;

Antidotes = *De antidotis libri ii*;

Avoiding Distress = *De indolentia* (περὶ ἀλυπησίας);

Blood in the arteries = *An in arteriis natura sanguis contineatur*;

Causes of Symptoms = *De symptomatum causis liber iii*;

Commentary on Hippocrates' Aphorisms (*Comm. Hipp. Aph.*) = *In Hippocratis aphorismos commentarii vii*;

Commentary on Hippocrates' Epidemics I (*Comm. Hipp. Epid. 1*) = *In Hippocratis librum primum epidemiarum commentarii iii*;

Commentary on Hippocrates' Epidemics III (*Comm. Hipp. Epidem. 3*) = *In Hippocratis librum iii epidemiarum commentarii iii*;

Commentary on Hippocrates' Epidemics VI (*Comm. Hipp. Epidem. 6*) = *In Hippocratis librum vi epidemiarum commentarii vi*;

- Commentary on Hippocrates' Fractures* (Comm. Hipp. Fractures) = *In Hippocratis librum de fracturis commentarii* iii;
- Commentary on Hippocrates' Joints* (Comm. Hipp. Joints) = *In Hippocratis librum de articulis et Galeni in eum commentarii* iv;
- Commentary on Hippocrates' Regimen in Acute Diseases* (Comm. Hipp. Reg. Acute Diseases) = *In Hippocratis de victu acutorum commentaria* iv;
- Commentary on Hippocrates' In the Surgery* (Comm. Hipp. Surgery) = *In Hippocratis librum de officina medici commentarii* iii;
- Compound Drugs Arranged by Kind* (Cmpds. by Kind) = *De compositione medicamentorum per genera libri* vii;
- Compound Drugs Arranged by Place* (Cmpds. by Place) = *De compositione medicamentorum secundum locos libri* x;
- Doctrines of Hippocrates and Plato* (Doct. Hipp. Plat.) = *De placitis Hippocratis et Platonis*;
- Glaucon, Method of Healing* = *Ad Glauconem de medendi methodo libri* ii;
- Hippocratic Glossary* = *Linguarum seu dictionum exoletarum Hippocratis explicatio*;
- Leeches, Revulsion, Cupping* = *De hirundinibus, revulsione, cucurbitula, incisione et scarificatione*;
- Maintaining Health* = *De sanitate tuenda libri* vi;
- Method of Healing* (Meth. Healing) = *De methodo medendi libri* xiv;
- Mixtures and Properties of Simples* (Simples) = *De simplicium medicamentorum temperamentis ac facultatibus libri* xi;
- On Affected Parts* (Aff. Parts) = *De locis affectis libri* vi;
- On Different Fevers* (Diff. Fevers) = *De differentiis febrium libri* ii;
- On Dissection of the Uterus* (Diss. Uterus) = *De uteri dissectione*;
- On Distinguishing pulses* (Dist. Pulses) = *De dignoscendis pulsibus libri* iv;
- On his Own Books* = *De libris propriis liber*;
- On Prognosis* = *De praenotione ad Posthumum (Epigenem)*;
- On Shoulder Dislocation in Ways not Seen by Hippocrates* (Shoulder Dislocation in Ways not Seen by Hipp.) = *De humero iis modis prolapso quos Hippocrates non vidit*;
- On the Natural Faculties* (Nat. Fac.) = *De naturalibus facultatibus*;
- On tremor, palpitation, spasm and rigor* (Tremor) = *De tremore, palpitatione, convulsione et rigore liber*;
- Properties of Foods* = *De alimentorum facultatibus libri* iii;
- Properties of Medicines for Purging* = *Quos quibus catharticis medicamentis et quando purgare oporteat (ap. Oribasium)*;
- Recognizing the Best Physician* = *De optimo medico cognoscendo*;

Theriac to Piso = *De theriaca ad Pisonem*;

Thrasybulus, Is Health Part of Medicine or Gymnastics? (*Thrasybulus, Is Health Med. or Gymn. ?*) = *Thrasybulus sive utrum medicinae sit an gymnasticae hygieine*;

Treatment by Venesection = *De venae sectione adversus Erasistratum*;

Use of Parts = *De usu partium*.

Pseudo Galen

Diagnosis and Treatment of Kidney Diseases (Kidney Diseases) = *De affectuum renibus insidentium dignotione et curatione liber adscript(iti)us*;

Drugs Easily Procured = *De remediis parabilibus libri iii*;

History of Philosophy (Hist. Phil.) = *De historia philosophica*;

Intro. or Physician = *Introductio seu medicus*;

Medical Definitions = *Definitiones medicae*;

Prognosis by Math. Sci. = *Prognostica de decubitu ex mathematica scientia*;

To Thrasybulus on the Best Sect (Thrasybulus Best Sect) = *De optima secta ad Thrasybulum liber*.

Hippocratic Corpus

Affections = *De affectionibus*;

Appendix to Regimen in Acute Diseases = *De dieta acutorum* [Sp.];

Breaths = *De flatibus*;

Crises = *De iudicationibus*;

Decorum = *De decente habitu*;

Diseases I–III = *De morbis i–iii*;

Diseases of Women I–III = *De mulierum affectibus i–iii*;

Epidemics = *De morbis popularibus*;

Excision of the Embryo = *De exsectione foetus*;

Fistulas = *De fistulis*;

Fractures = *De fracturis*;

Hemorrhoids = *De haemorrhoidibus*;

In the Surgery = *De officina medici*;

Instruments of Reduction = *Vectarius*;

Internal affections = *De affectionibus interioribus*;

Joints = *De articulis*;

Nature of Women = *De natura muliebri*;

Physician = *De medico*;

Places in Man = *De locis in homine*;

Regimen in Acute Diseases = *De dieta in morbis acutis*;

Sight = *De visu*;

Ulcers = *De ulceribus*;

Use of Liquids = *De humidorum usu*;

On Head Wounds = *De capitis vulneribus*.

Oribasius

Medical Compilations or Compendium of Medicine (*Coll. Med.*) = *Collectiones Medicae*;

Medical Compilations, Reference Uncertain (*Coll. Med., Lib. Inc.*) = *Collectiones Medicae, Libri Incerti*;

Selected Remedies from the Book of Oribasius to the Emperor Julian (*Ecl. Med.*) = *Eclogae Medicamentorum*;

Synopsis to his Son Eustathius (*Syn.*) = *Synopsis ad Eustathium filium*;

Handbook for Eunapius (*Eunap.*) = *Libri ad Eunapium*.

List of Figures

FIGURE CAPTION

- 1 Alinari Photo, no. 19086. Instruments from Vesuvian Cities. Late nineteenth century
- 2 Alinari Photo, no. 19087. Instruments from Vesuvian Cities. Late nineteenth century
- 3 Instrumentarium from Italy. Length of longest catheter 30.25 cm. 1st–early 2nd century CE.
- 4 Cupping Vessel, Corinth. Ht. 9.1 cm. Ca. 500 BCE.
- 5 Cupping Vessel, Thebes. Ht. 14.8 cm. Ca. 500 BCE.
- 6 Cupping Vessel, Tanagra. Ht. 14.8 cm. Traditionally dated 500 BCE but probably Hellenistic
- 7 Cupping Vessels, Pompeii. Ht. of largest 14.8 cm.
- 8 Post Classical Cupping Vessels. Ht. of largest 5 cm.
- 9 Bellied or “D” Type Scalpels, Pompeii. L. of longest 15 cm.
- 10 Scalpel Handles (One Perhaps with Blade of “Crow/Raven” type), Pompeii. L. of “Crow/Raven” 17.1 cm.
- 11 Scalpel, Forceps and Retractor Types: Domus “del chirurgo,” Rimini. 3rd cent. CE.
- 12 Scalpel Handles, probably Pompeii. L. of longest 8.5 cm.
- 13 Scalpel Handle, “Hercules Type,” Pompeii. L. 7 cm.
- 14 Scalpel with Handle of Fluted Pilaster Type, Asia Minor. L. 13.3 cm. 1st–2nd cent. CE.
- 15 Scalpel Handle with Ivy Pattern Damascened in Silver and Copper, Asia Minor. L. 9 cm. 2nd cent. CE.
- 16 Phlebotome (likely veterinary), Pompeii (VI 1, 9–10.23 = House of the Surgeon) L. 11.7 cm.
- 17 Three Bladed Phlebotome?, Rome. L. 16.9 cm.
- 18 Lancet-like Spatula (perhaps also serving as a lancet), Baltimore. L. 13.3 cm.
- 19a Knife with Spoon: allegedly Ephesus. L. 11.5 cm.
- 19b Spatula with Spoon: allegedly Ephesus. L. 18.5 cm.
- 20 Portion of Instrumentarium allegedly from Ephesus. Left-Rt.: three sharp retractors, sharp retractor converted from stylus, double needle, spatula probe, lancet-cautery, three spoon probes (two with roughened interiors), two-prong stone retractor, and two lithotomy knives. Retractor at far left is longest item at 17.4 cm.; retractor 4th from left shortest at 8.1 cm. 1st half, 3rd century CE.

- 21 Relief now in Berlin; Candidate for Lithotomon of Meges 3rd from left
- 22 The Milne-Daremborg Version of Meges' Lithotomon
- 23 Tonsil Knives: Domus "del chirurgo," Rimini. 3rd cent. CE.
- 24 Bow Shears, Pompeii. L. 9.8 cm.
- 25 Basic Spatula Types (rectangular, swallowtail, oval, fish). 1st century CE.
- 26 Spatula Types, Pompeii (lancet/spear-like). L. 14–13.8 cm.
- 27 Spatula Types, Pompeii. L. 17.3–14.3 cm.
- 28 Large Double Spatula Types, Pompeii. L. 17.3–17 cm.
- 29 Portion of Instrumentarium allegedly from Ephesus. Left-rt.: (19–22) four small scalpel handles (19–21 octagonal in section), (28–29) two medicine or instrument containers, (27) stylus, (26) small spatula, (25) fragmentary spatula, (24) small ear probe, (23) small needle/probe, (18) lithotomy knife, (30–35) six ear probe/ligula types, (36) dipyrene probe. Lithotomy knife longest item at 16.9 cm, fragmentary spatula shortest at 2.5 cm. 1st half, 3rd century CE.
- 30 Ophthalmic Needles with Container, Dredged from River Saône (Montbellet). L. of container without lid 18 cm.; L. of longest needle 16.5 cm.
- 31 Interior View of Ophthalmic Needle with Retractable Stem. L. 13.5 cm.
- 32 Ophthalmic Needles/Knives, Gaius Firmius Severus Instrumentarium, Rheims. L. 8–6.2 cm. Late 2nd–early 3rd century CE.
- 33 Forceps–Needle Holder Combination, Melos. L. 14 cm. Early Empire
- 34 Trocar?: allegedly from Ephesus. L. 12.7 cm.
- 35 Cautery: allegedly from Colophon. L. 16.8 cm. 1st–2nd cent. CE.
- 36 Lunated Cautery, Bingen-am-Rhein. L. 9.5 cm. 1st half 2nd cent. CE.
- 37 Sharp Retractor, Provenance Unknown, Now Bloomington, Indiana (USA)
- 38 Instruments Recovered at Aschersleben Including: (1) sharp retractor, (2) lever forceps combination, (3) knife or chisel, (4) lever with slot for another lever or blade, and (5–6) two fragments, one a grip. L. 17.4 (retractor)—5.1 (fragmentary grip). Perhaps 3rd cent. CE.
- 39 Double Retractor: allegedly from Colophon. L. 16.5 cm. 1st–2nd cent. CE.
- 40 Blunt Retractor: allegedly from Colophon. L. 11.6 cm. 1st–2nd cent. CE.
- 41 Probable Retractor for Bladder Stone, Provenience Unknown, Now Cambridge (UK) L. 8.5 cm.
- 42 Sharp Retractor–Needle Holder, Pompeii (IX 9, 3–5 = Casa del Medico Nuovo (II)). L. 14.4 cm.
- 43a Scoop of Diocles? Domus "del chirurgo" at Rimini: L. 11 cm. 3rd cent. CE.
- 43b Scoop of Diocles? (profile view)

- 44 Meyer Steineg's Candidate for the Scoop of Diocles. L. 18.6 cm.
- 45 Instruments for Bone Surgery: file and saw: Domus "del chirurgo," Rimini. 3rd cent. CE.
- 46 Extended Bow Drill, allegedly from Colophon. L. 39 cm. 1st–2nd cent. CE.
- 47 Bow with Crown Drills: Bingen-am-Rhein. 1st half 2nd cent. CE.
- 48a–b Curette: allegedly from Colophon. L. 19.5 cm. 1st–2nd cent. CE.
- 49 Instruments for Bone Surgery: stump forceps (14), two sequestrum forceps (15–16), blunt retractor probably serving also as guard (17), bone lever (18), chisel handle (19), bow drill (20), gouge (21), lenticulars (22–23). Domus "del chirurgo," Rimini
- 50 Bone Levers/Elevators, Pompeii. L. 18.5–16 cm.
- 51 Handle of Bone Lever/Elevator, Pompeii. L. 8.4 cm.
- 52 Scalpel Handle and Four Bone Levers/Elevators, Bingen-am-Rhein. L. (left-rt.) 10–17.5 cm. 1st half 2nd cent. CE.
- 53 Bone Lever/Elevator, Domus "del chirurgo," Rimini. 3rd cent. CE.
- 54 Forceps Combined with Bone Lever: Paris. Perhaps 275 CE.
- 55 Surgical Tubes, Pompeii: one and probably both from VI 1, 9–10.23 = House of the Surgeon. L. 17.4 and 13.7 cm.
- 56 Clyster Tubes, Pompeii, the longer from IX 9, 3–5 = Casa del Medico Nuovo (11). L. 18 and 15 cm.
- 57a–b Perforated Tube, allegedly from the "Holy Land." L. 9.7 cm.
- 58a–b Injection Tube, likely Puoulkos: Nea Paphos. L. 20.2 cm. Mid 2nd–early 3rd cent. CE.
- 59a Catheter, allegedly from Colophon. 1st–2nd cent. CE.
- 59b Detail, Catheter, allegedly from Colophon (showing eye and open seam).
- 60 Cannulae, Pompeii. L. 12.4, 9.3 cm.
- 61 Cannula, Perhaps also Clyster Tube, Allianoi (Turkey). L. 11.5 cm. Late 1st to mid. 3rd cent. CE.
- 62 Insufflator, Paris (Lutetia), Paris. L. 15.5 cm. Perhaps 275 CE.
- 63 Bone (Sequestrum) Forceps, allegedly from Colophon. L. 22 cm. 1st–2nd cent. CE.
- 64 Bone (Sequestrum) Forceps, Pompeii. L. 22 cm.
- 65 Dental Forceps, Wederath: Trier. L. 15.5 cm.
- 66 Uvula Forceps with Plunger Handle. L. 24 cm.
- 67 Forceps Type, Proposed as Hemostat: Allianoi (Turkey), Kat. Nu. 297: L. 7.6 cm. Late 1st to mid. 3rd cent. CE.
- 68 Angled Forceps (as drawn by Savenko at Portici)
- 69 Forceps, allegedly from Colophon. L. 19.5 cm. 1st–2nd cent. CE.

- 70a Quadrivalve Uterine Speculum, Pompeii (Probably VIII 5, 24 = Casa del Medico Nuovo I). L. 31 cm.
- 70b Quadrivalve Uterine Speculum, Pompeii (backside)
- 70c Quadrivalve Uterine Speculum, Pompeii, Detail (worm, crossbar, ram's head)
- 71 Trivalve Uterine Speculum, Pompeii (VIII 3, 10–12 = House of the Medicus A. Pumponius Magonianus). L. 20.7 cm.
- 72 Trivalve Uterine Speculum, Pompeii (IX 9, 3–5 = Casa del Medico Nuovo II). L. 20.5 cm.
- 73 Bivalve Rectal Specula, Pompeii (the larger from IX 9, 3–5 = Casa del Medico Nuovo II). L. 18 and 15 cm.
- 74 Embryo Hook (current condition and as drawn by Vulpes), Pompeii. Current L. 7.7 cm.
- 75 Embryo Hook/Retractor? (formerly in Meyer-Steineg Collection in Jena, now missing)
- 76 One Element of a Cranioclast (now lost and as restored) and an Embryo and/or Lithotomy Hook, allegedly from Ephesus. Lengths. 17 and 15.5 cm.
- 77 Fragments of Proposed Embruosphaktes, Devnja, Bulgaria (Marcianopolis)
- 78 Birthing Scene Featuring Midwife's Chair. Relief from Tomb of 2nd cent. CE on Isola Sacra, Ostia
- 79 Box for Medicines, Pompeii (V 5, 1–2 = Casa del Medico dei Gladiatori). L. 11, w. 6.4 cm.
- 80 Box for Medicines or Cosmetics, Pompeii (VI 14, 27 = House of M. Memmius Auctus). L. 7.7, w. 5.5 cm.
- 81 Medicine Box with Pills (now missing), Pompeii. L. 18, w. 10 cm.
- 82 Medicine Box Dredged from Rhine, now lost. L. 10 cm, W. 8 cm., Ht. 2 cm.
- 83 Two-tiered Box from Cyzicus for pills on one level and instruments on the other. The instruments, some of which can be seen as shadows on the underside of the lid (upper left), include: 3 scalpels, 2 sharp retractors (one featuring a needle holder), 2 forceps (the larger dentated), and a small ligula. A spatula probe was independent of the box. The entire ensemble was lost in World War II but the 2 retractors and the 2 forceps have since been recovered. L. of box calculated at 16 cm. based on length of retractor/needle holder (15.4 cm.). Probably late 1st–early 2nd cent. CE.
- 84 Instruments in Cylindrical Carrying Case (which lacks its cover), Pompeii (IX 9, 3–5 = Casa del Medico Nuovo II). L. of spatula 19.7 cm.

- 85 Segmented Cylindrical Case, Italy. Ht. 21.4 cm. 1st–early 2nd century CE.
- 86 Grave Furnishings, Cologne, including: a clay bowl, two small greenish glass containers, a small case (Hülse), a bright (helles) glass bowl and a small cask (Fässchen). 2nd–4th cent. CE.
- 87 Bright Glass Container (Balsamarium), Cologne. 3rd–4th cent. CE.
- 88 Ash Urn, Rheims
- 89 Glass and Other Containers and Instruments, including scalpels, retractors, needles and shears: Nijmegen/Noviomagus. 3rd cent. CE.
- 90 Bronze Kettle, Paris (Lutetia). Perhaps 275 CE. Ht. 11 cm, Max. W 20 cm.
- 91 Iron medicine pot (accompanied by two reproductions): Gaius Firmius Severus Instrumentarium, Rheims. Ht. 7.5 cm. Late 2nd–early 3rd century CE.
- 92 Scale/Balance: allegedly from Colophon. L. of beam 30 cm. 1st–2nd cent. CE.
- 93 Steelyard: Gaius Firmius Severus Instrumentarium, Rheims. L. of beam 27.5 cm. Late 2nd–early 3rd century CE.
- 94 Forceps?: Allianoi (Turkey). L. 20.3 cm. Late 1st to mid. 3rd cent. CE.
- 95 Iapyx Treats Wounded Aeneas, (House of Siricius, Pompeii)

Acknowledgements and Permissions for Figures

- 3 Photo courtesy of the British Museum.
- 4–6 Nat. Arch. Mus. Athens: photos by author.
- 7 Nat. Arch. Mus., Naples: photo Römisch-Germanisches Zentralmuseum, Mainz (hereafter RGZM) L1041/7.
- 8 Photo courtesy of University Museums, University of Mississippi.
- 9–10 Nat. Arch. Mus., Naples; Photos RGZM L1036/6, L1034/6.
- 11 Drawings by Ralph Jackson as they appeared in *Ars Medica* 2009.
- 12–13 Nat. Arch. Mus., Naples: photos RGZM L1038/10, 1036/2.
- 14–15 Photos RGZM.
- 16 Nat. Arch. Mus., Naples: photo RGZM L1040/5.
- 17 Drawing by Ralph Jackson.
- 18 Photo by William Denison.
- 19a–19b With kind permission of Ernst Haekel-Haus, Friedrich-Schiller-Universität: photos RGZM T 91/1066–1068, T 91/1062–1063.
- 20 Photo RGZM.
- 21 Photo courtesy of Staatliche Museen zu Berlin, Antikensammlung: photographer Johannes Laurentius.
- 22 Drawing by Alexander Hollmann.
- 23 Drawing by Ralph Jackson.
- 24 Nat. Arch. Mus., Naples: photo RGZM L1034/6.
- 25 Drawings by Alexander Hollmann.
- 26–28 Nat. Arch. Mus., Naples: photos RGZM L1035/2, L1036/12, L1036/11.
- 29–30 Photos RGZM.
- 31–32 Drawings RGZM.
- 33 Drawing by Martin, 1855.
- 34 With kind permission of Ernst-Haekel-Haus, Friedrich-Schiller-Universität: photo RGZM T 91/1089–1090.
- 35 Photo courtesy of Johns Hopkins Archaeological Museum.
- 36 Photo courtesy of Stadtverwaltung Bingen/Rhein.
- 37 Photo courtesy of Indiana University Art Museum.
- 38 After Künzl (1983) 101 Abb. 80.
- 39–40 Photos courtesy of Johns Hopkins Archaeological Museum.
- 41 Cambridge Museum of Classical Archaeology; photo RGZM.
- 42 Nat. Arch. Mus. Naples: photo RGZM L1041/5.
- 43a–43b Drawings by Alexander Hollmann.

- 44 With kind permission of Ernst-Haekel-Haus, Friedrich-Schiller-Universität; photo RGZM T 91/1086–1088.
- 45 Drawing by Alexander Hollmann after renderings by Ralph Jackson as they appeared in *Ars Medica* 2009.
- 46 Photo courtesy of Johns Hopkins Archaeological Museum.
- 47 Drawings by Ralph Jackson.
- 48a–b Photos courtesy of Johns Hopkins Archaeological Museum.
- 49 Drawings by Ralph Jackson as they appeared in *Ars Medica* 2009.
- 50–51 Nat. Arch. Mus. Naples: photos RGZM L1037/5, RGZM L1039/2.
- 52 After Como 1925.
- 53 Drawing by Alexander Hollmann after renderings by Ralph Jackson as they appeared in *Ars Medica* 2009.
- 54 Drawing RGZM after Deneffe 1893.
- 55–56 Nat. Arch. Mus., Naples: photos RGZM L1037/4, L1037/4, L1039/7.
- 57a–57b Photo courtesy of Smithsonian Inst. 91-3188/31: drawings by Alexander Hollmann.
- 58a–58b With the kind permission of the Director of the Department of Antiquities, Cyprus: photo by A. Koutas; drawing by K. Kapitanis.
- 59a–59b Photos courtesy of Johns Hopkins Archaeological Museum.
- 60 Nat. Arch. Mus., Naples: photo RGZM L1039/4.
- 61 Drawing by Ceren Baykan provided with kind permission of Daniş Baykan (2012) p. 203.
- 62 Drawing RGZM after Deneffe 1893.
- 63 Photo courtesy of Johns Hopkins Archaeological Museum.
- 64 Nat. Arch. Mus., Naples: photo RGZM L1032/4.
- 65 After Künzl (1983) 71 (Abb. 45).
- 66 Drawings by Ralph Jackson.
- 67 Drawing by Alexander Hollmann, after Ceren Baykan in Baykan (2012) p. 145.
- 68 Drawing by Savenko 1819.
- 69 Photo courtesy of Johns Hopkins Archaeological Museum.
- 70a–70c Nat. Arch. Mus., Naples: photos RGZM 1031/1, L1041/1, 1042/10.
- 71–74 Nat. Arch. Mus., Naples: photos RGZM L1038/4, 1038.7, L 1032.8, L1036/4.
- 75 Photo taken from Buchheim [1916] 44 Abb. 7.
- 76 With kind permission of Ernst-Haekel-Haus, Friedrich-Schiller-Universität.
- 77 After Kirova 2002.
- 78 Photo Dept. of Classics, U. of Washington.

- 79–80 Nat. Arch. Mus., Naples: photos RGZM L1042/3, L1039/9.
81 Photo Courtesy of Nat. Arch. Mus., Naples C/844.
82 Photo RGZM.
83 Photo Staatl. Museum zu Berlin, DDR, Inv. no. 10576; Neg. no. 3933,
passed to author in 1992.
84 Nat. Arch. Mus., Naples: photo RGZM L 1034/3.
85 Drawing by Ralph Jackson.
86–87 Courtesy of LVR-LandesMuseum Bonn; photos by Ernst Künzl.
88 Photo Courtesy Musée d'Histoire de la Médecine, Paris.
89 Photo courtesy of Rijksmuseum van Oudheden, Leiden, NL.
90 Drawings RGZM after Deneffe.
91 Photo Ernst Künzl.
92 Photo courtesy of Johns Hopkins Archaeological Museum.
93 Photo Ernst Künzl.
94 Drawing by Alexander Hollmann, after Ceren Baykan in Bayken (2012)
p. 145.
95 Drawing by Alexander Hollmann, after image supplied by Patrick
Hunt.

Introduction

The Study of the Instruments in Modern Times

Phenomenal advancements have been made in western medicine since the end of the 19th century. So much progress in so short a time naturally leads one to look past the less effective medicine of previous eras. And, when it comes to the most radical intervention of all, surgery, our attitudes may actually become condescending. Yet, the past three decades have seen a burst of scholarly activity in the study of Greco-Roman surgery. Interest in the topic has been fueled mainly by the recovery of more of the instruments used by practitioners between the first and fifth centuries of our era and the restudy of those already known. When one considers these tools in conjunction with surviving medical literature relating to this same period, it becomes clear that something like 120 different operations were being performed, at least in some places at some times, over the course of the Roman Empire. Galen gives a brief synopsis of the possibilities.

There is an operation for each part of the body, which we employ when we stitch up the eyelids and another completely different one for couching cataracts. There are three or four others bearing no similarity to one another, nor to those by which we cut away fractured bone from the skull, while in another part of the body (for example the arm and the forearm) we reduce and set and bind up fractures. Surgery for hernia is altogether distinct from such operations, just as surgery for varicose veins is from it, and just as the operation for bladder stone is from all those mentioned. For the majority of these interventions we operate with a scalpel. On the other hand to anoint eyes or reduce limbs or to put a plaster on a part or to employ a catheter properly or to apply a cupping vessel requires no scalpel. These procedures are also completely distinct from one another and from all those aforementioned, just as to cut a vein and divide an artery and split the skin and perform paracentesis on patients with dropsy are operations distinct from one another and from all those aforementioned. These and all kinds of other surgeries in addition are performed with the hands themselves.¹

1 *Thrasylbulus, Is Health Med. or Gymn.* ? 5.844K: "ἐστὶν οὖν τις ἐνέργεια κατὰ μέρος, ἥ χρώμενοι τὰ βλέφαρα τῶν ὀφθαλμῶν ἀναρράπτομεν, ἐτέρα δὲ τῇδε μὴδὲν εἰσικύια, δι' ἧς ὑποχύματα παράγομεν,

While many of the interventions of Galen's time were only performed in the orifices, or along the surface of the body, some, such as those for hernias and bladder stone, seem remarkably adventurous. That factor too has provoked my interest, even admiration, and accounts in good part for this investigation of Greco-Roman instruments and the literary testimonia for their appearance and use.

Earlier Work on the Instruments

Contemporary interest in the study of Greco-Roman surgery was prompted by the excavation of the cities buried by Mt. Vesuvius in 79 CE. From the third decade of the 18th century, when Bourbon engineers began tunneling operations, to the present day, objects interpreted as surgical tools have been recovered at Vesuvian sites, beginning with Herculaneum in 1738 and, especially, with Pompeii in 1748. Initially, finds were taken to the Royal Palace at Portici. There they were first treated by Monsignor Antonio Bayardi in 1754.² Bayardi's *Catalogo* was roundly criticized for its lack of illustrations and unsystematic and uneven descriptions. All the same he deserves credit for trying to link each instrument type with details as to shape and function in the writings of medical authorities of the Roman Empire. After the tools had been transferred to the current Naples museum, a more careful investigator, Benedetto Vulpes, Chief Surgeon in the Ospedale Real di Napoli, delivered before the Real Accademia Ercolanese di Archeologia a series of now classic lectures on them. In 1847 these were collected into a book offering in hand drawings the first good illustrations.³ Some sixty years later J.S. Milne, a Scottish surgeon with a

ἄλλαι δὲ τρίτη καὶ τετάρτη μῆτ' ἀλλήλαις τι μῆτε ταῖσδε προσεοικυῖαι, καθ' ἃς ὅστων κατεαγὸς ἐκ μὲν τῆς κεφαλῆς ἐκκόπτομεν, ἐν ἄλλῳ δὲ μέρει τοῦ σώματος, οἷον βραχίονι καὶ πῆχει, κατατείναντές τε καὶ διαπλάσαντες ἐπιδοῦμεν. ὧν ἀπασῶν ἐνεργειῶν ἀποκεχώρηκε πάμπλου κήλης χειρουργία καὶ ταύτης ἡ τῶν κισῶν καὶ πασῶν ὁμοῦ τῶν εἰρημένων ἢ τοῦ κατὰ τὴν κύστιν λίθου. καὶ τούτων μὲν ἔτι τὰ πλεῖστα μετὰ σμίλης ἐνεργοῦμεν· ὑπαλείψαι δ' ὀφθαλμὸν ἢ ἄρθρον ἐμβαλεῖν ἢ καταπλάσαι τι μέρος ἢ καθετήρι χρῆσθαι καλῶς ἢ σικύαν κολλῆσαι γίγνεται μὲν ἄνευ σμίλης, ἀποκεχώρηκε δὲ καὶ ἀλλήλων πάμπλου καὶ τῶν προειρημένων, ὥσπερ γε καὶ τὸ φλέβα τεμῆν καὶ ἀρτηρίαν διελεῖν καὶ ἀποσχάσαι τὸ δέρμα καὶ παρακεντῆσαι τοὺς ὑδριῶντας ἀλλήλων διενήνοχε καὶ συμπάντων τῶν προειρημένων. καὶ αὗται μὲν ἔτι καὶ πρὸς ταύταις ἕτεραι μυρία χειρουργία τινὲς ἐνεργοῦνται δι' αὐτῶν <τῶν χειρῶν>. For a humorous brief summary see also Martial *Epig.* 10.56. NB: Unless otherwise specified, all translations are my own.

2 Bayardi (1775) 359–65.

3 Highly stylized drawings were made by the Russian physician Pyotor Savenko in 1819 (Froriep 1822) and still earlier and equally inaccurate versions were reproduced by Védrenes in his

good background in classical languages, enlarged the picture by incorporating into his work instruments from other sites in Western Europe, in particular Britain, France, Germany and Switzerland. In so doing he recognized and identified a number of instrument types not occurring in Naples. Milne's *Surgical Instruments in Greek and Roman Times* (1907) remains the definitive handbook on the subject and a work to which I am deeply indebted, as shown by my retaining the title of his book in my own.

However much we owe to Milne, inevitably after more than a century a new treatment is warranted. I have tried to build on his pioneering effort in several important respects. Although, like Vulpes, Milne cited many of the more important testimonia from the ancient sources, he did not include many others that are informative, especially testimonia in Oribasius;⁴ and while his general intention was clearly to translate the Greek or Latin text at issue, he sometimes did not produce the original; or, vice versa, he sometimes quoted the original but without a translation. This leads to frustration of both scholars, who appreciate seeing the original languages, and non-specialists, who cannot read them. Initially, I had hoped to translate all citations included in this work. However, I soon realized that there simply would not be time to complete the task for each and every one, and that many would be fairly redundant. Besides, space would become an issue even if universal translation were possible. So, in the end, rather than translate all passages, I have often paraphrased sources I wished to feature, while including the original Greek or Latin either in the text itself or in a footnote. Other redundant or less important passages I simply list, sometimes in small print summaries. For those not acquainted with the classical tongues and who desire a full translation of the originals, the chapter Primary Sources and Translations may be consulted. Also, bearing

edition of Celsus (1876). Speculation on who might have produced Védrenes' drawings can be found in Bliquez, Jackson (1994) 14–15 along with the drawings themselves (Plates I and IV).

4 This is also true for the extensive collection of testimonia made by K.G. Pournaropoulos (1973). While Pournaropoulos' collection of passages is the most complete to date, random soundings of his assemblage reveal the absence of numerous relevant references; moreover, he includes absolutely no illustrations and his work is in modern Greek, features which considerably limit its utility (it is in fact virtually unavailable in America). I thought it essential that all passages be collected and considered. For example, although Pournaropoulos cites the very full reference in Paul of Aegina to an instrument called the 'lunated cautery', he ignores another reference to the same tool in Oribasius. Now we learn no more about the instrument itself in Oribasius but, since he lived several hundred years before Paul, we can conclude from his text that the instrument existed much earlier than the 7th century and we can guess at the source of Oribasius' information. These steps then allow us to speculate on who invented the tool, and so on.

these readers in mind, I have often used the English titles commonly given to classical works in Greek and Latin, or created my own abbreviated versions, especially when citing the *Hippocratic Corpus* or Galen. Thus Galen's treatises *De Simplicium Medicamentorum Temperamentis ac Facultatibus* and *De Compositione Medicamentorum secundum Locos* are cited respectively as *Simples* and *Cmpds. by Place*.

Milne's illustrations are perhaps even more problematic. As Vulpes', his work was affected by contamination, that is to say the tendency over time in museum collections to combine surgical instruments with other everyday items intended for use in the home or workshop. This happens because many everyday items, such as spatulas, tweezers and spoons, were also useful to physicians. In consequence, Milne attributes to Roman surgery articles never used as such: e.g., post classical cutlery taken as scalpels (p. 27), large bodkins seen as stylets used in abortions (p. 158), tubes from non-medical contexts interpreted as dilators and catheters (pp. 82, 145), post classical cupping vessels (p. 103), a crude piece of curved metal mistakenly identified as a lithotomy scoop (p. 147), and so on. Items like these might have deceived Milne, and both he and Vulpes often included non-surgical material in their studies, because no firm identification of instrument types had been worked out by or for them.⁵ This obstacle was overcome in the early 1980's through the typological studies of Ernst Künzl and his collaborators. Especially important was his ground breaking *Medizinische Instrumente aus Sepulkralfunden der römischen Kaiserzeit*. In classifying the various instrument types, Künzl confined himself strictly to 'closed finds'; that is, to instrumentaria removed from the graves of Imperial surgeons, as opposed to museum collections in which surgical instruments are so often contaminated.⁶ His efforts and my own attempts with the help of Ralph Jackson to isolate authentic Pompeian surgical material by carefully tracing the proveniences (usually houses) of pieces of interest in the Naples Museum enable us to confirm or reject with confidence many of the positions assumed by Vulpes and Milne. Thus the illustrations of the various instrument types included in the present work should mark a considerable improvement.

5 The same difficulties apply to the contributions of Meyer Steineg (1912) and Tabanelli (1956, 1958).

6 The collection in the Naples Museum provides a good example of this tendency: see Bliquez, Jackson (1994) 6–8. It is yet unclear why their gear was interred with deceased physicians, as opposed to other professions where this generally did not happen. A recently developed theory posits pollution as a cause: see Baker (2004). Baker considers other functions instruments might have had, such as divine/magical properties, in her recent book of 2013.

Another reason for a new treatment of the subject is the recovery and publication of new material. Ample instrumentaria from graves at Colophon (1914), Bingen (1925), Asia Minor (1980), Cyprus (1984), and Italy (1986), combined with site finds, such the fabulous Domus 'del chirurgo' at Rimini (2000) with approximately 150 instruments and related paraphernalia,⁷ and now the complex at Alliano, ⁸ have provided us with examples of tools attested in the literature which were unknown to Milne and his predecessors: special cauteries, surgical knives with blades for specific purposes, such as those for removal of bladder stone, new tubes, including the female catheter and (probably) the syringe called *puoulkos*. To these we may add crown drills and the bows to drive them, not to mention other tools for bone surgery: the gouge and lenticular, for example. In addition to material from graves, houses, and odd sites like baths, 'hoards', and military forts with *valetudinaria*,⁹ new sources for instruments are emerging from underwater finds. A shipwreck from the Gulf of Baratti (Populonia) has yielded a trove of wooden medicine containers with contents intact,¹⁰ while the River Saône has produced unique needles for treating cataracts.¹¹ On the negative side forgeries have appeared, which, until exposure, have served as unwanted distractions.¹²

Finally, it was Milne's practice to bundle together all literary testimonia to a particular category of instrument from the Hippocratics to Imperial times. I have chosen to separate the two. Thus, I begin with a chapter on Hippocratic tools and paraphernalia and then proceed to treat the material remains of the Empire, though, as Milne, I deal with both the Hippocratic and the Imperial instruments by types: e.g. Cupping Vessels, Cutting Instruments, etc. In this

7 For the layout of this house see Ortalli (2000 and 2008); for a review of its instruments and parasurgical gear see Jackson (2003) 314 and (2009b) 73–91.

8 For this intriguing site in Western Turkey near Bergama (Pergamon) and a full catalogue of the material found there see Baykan (2012) in conjunction with Vivian Nutton's review (2014), written after additional communication with Professor Baykan.

9 For baths at Xanten, Trier, and Weissenburg as well as recoveries from Paris, Sontheim, and military posts, see Künzl (1983a) 74–77, (1986a) and (2002a) 42–45.

10 Spawforth (1990), Gibbons (1997); see also the wreck at Plemmirio near Syracuse as reported by Gibbons (1989).

11 Feugère, Künzl, Weisser (1985). To this add three other river finds, the most interesting being that extracted from the Rhein near Mainz: see Künzl (1993) 99–102 and (2002a) 45–46.

12 These were exposed by metal analysis (Bliquez [1986], Künzl [1986]). Outright forgeries are to be distinguished from the reproductions of tools manufactured openly in the 19th and early 20th century by the Neapolitan firms J. Chiurazzi and Sons, S. De Angelis and Sons, and G. Sommer and Son; see Tarbell (1909) for examples in Chicago's Field Museum.

way one can see separately what was available to the Hippocratic practitioner in the 5th and 4th centuries BCE and, at the same time, better appreciate the advancements, both in tools and their application, beginning in the Hellenistic world and emerging fully in the Roman.

Emphasis on Nomenclature

There were several general terms used for surgical tools. These include in Greek ἄρμενον/α, ὄργανον/α and ἐργαλεῖον/α in Greek and *ferramentum/a* in Latin.¹³ When the names of particular tools are at issue, the reader will find I have taken some trouble over the terms found in the literature.¹⁴ The reason is this: anyone who deals with the Greco-Roman surgical tools of the Empire soon notices that there are rather more names in the literature than there are authenticated surviving instruments to be designated by them; so often a particular instrument type bears several names.¹⁵ As a Greek example we may take the dentated spring forceps. This may be called σαρκολάβον or μύδιον (Paul of Aegina, 6.8.2; 6.17.1). Again, an elevator may be designated ἀναβολεύς as well as μοχλίσκος (Paul of Aegina, 6.88.9; 6.107.2), or a catheter αὐλίσκος as well as καθετήρ (Aëtius of Amida, 6.34; 11.27).

The author Celsus sometimes presents just the opposite problem. He is fond of using general terms in Latin for a variety of tools. *Ferramentum*, for example, is a favorite randomly applied name, while *specillum* is used to designate any type of probe.¹⁶ One here recalls Lucretius' complaint that Latin lacked the technical terminology that enriched Greek (*On the Nature of Things* 1.136–145). Thus, when dealing with Celsus, one has to weigh context carefully.

13 Ἄρμενον (Galen, *Avoiding Disress* 4, 10, and 12a; Erotian, Fr. 37); ἐργαλεῖον (Aëtius 16.108.24, *Lists* = Schöne (1903) 280, Bliquez (1984) 191 and Fischer (1987) 30); ὄργανον/ἄρμενον ([Hippocrates] *In the Surgery* 3.2.2L, Plato, *Statesman* 298c, Galen, *Comm. Hipp. Epidemics* 5, 17b.231–33K, Engelman, Knibbe, Merkelbach [1980] 108–112 nos. 1161–69, Oribasius, *Coll. Med.* 45.18.15); *Ferramentum* (Celsus 5.26.35B).

14 See also Proff (1992) who has wrestled with this issue.

15 A modern analogy might be application of the names couch, davenport and ottoman to the same object.

16 For instruments Celsus refers to as *ferramentum* see: 7.5.2B (rectal speculum?), 7.5.3A (scoop of Diocles), 7.5.4B (*ferramentum* for striking a missile lodged in bone), 7.10.1 (polyp knife and hook), 7.19.7 (crowbill), 7.26.1C (lithotomy hook), 7.26.2N (lithotomy knife of Meges), 7.26.3B (chisel to break calculus), 8.3.1 (choinix), and 8.4.10 (instruments for cutting out bone fragments).

Later writers in Latin, like Caelius Aurelianus, are less troublesome because they incorporate the more detailed Greek terminology.

The same tendency to use a single term for more than one instrument also sometimes occurs in Greek sources. The term *σίδηρος* serves as an example. It can designate the common scalpel or its blade. On the other hand it also occurs as the name of the cautery and at least twice as a forceps.¹⁷ So too, the name *αὐλίσκος* may apply to the catheter or to any tube used by a physician, such as a clyster or drainage tube.¹⁸ Probes are particularly notable in this respect: the terms *μήλη*, *μηλωτίς*, *μηλωτρὶς* and *specillum* might be applied to the spatula probe, the double probe (*dipyrène*), and the ear probe or ligula.¹⁹

Sometimes I strongly suspect that an instrument takes on a different name as its function changes. Take the term *φλεβοτόμον/phlebotomon* for instance, which occurs frequently in texts dealing with bleeding. If by *phlebotomon* one envisages a lancet like cutting instrument, it is noteworthy that actual survivals are few (see Tools of the Empire, Cutting and Puncturing Instruments). We are thus led to the conclusion that *phlebotomon* often masked the common scalpel, or *smile*, and its diminutives. In other cases, when two instruments are cited as suitable for a procedure, one wonders if they are not one and the same. A case in point is the common spatula probe paired with other tools that must have been similar in form such as the *meningophulax*, used as a guard in bone surgery or the *hupospathister*, a type of dissector; and so on.

On occasion, a name is all we have to go on: in other words it cannot be matched for sure with a surviving tool. In some cases these names have to do with what I term ‘virtuoso’ instruments; that is, fancy devices invented by a surgeon of renown for a particular purpose: e.g. Heron’s cupping vessel, Meges’ knife for bladder stone, the wound scoop of Diocles, and the trident cautery of Marcellus. In others, the instrument seems to have been in more common use, if it was a distinct instrument at all. A number of such tools, such as the rib saw (*pleuoprister*) and the gut guard (*enterophulax*) occur on bookish lists in both Greek and Latin that emerge in the Middle Ages.²⁰ These same lists

17 For *σίδηρος/ον* as a cautery see, e.g., Paul 6.44.2; 6.49.1; as a forceps [Hippocrates] *Barrenness* 37Potter = 8.249Littre; Aristotle, *Mechanics* 854a 20.

18 Galen, *Meth. Healing* 10.301 and 337K = J-H 1.456–457 & 2.48–49 (clyster), Aëtius 6.34.22 (catheter), Alexander of Tralles, *Therap.* 2.363.20–22 (tube and bellows for ileus), Paul 6.81.1 (tube to prevent contraction in treatment of imperforate anus).

19 Bliquez (2003) and below, the lengthy section on Probes under Tools of the Empire.

20 Earlier but more limited lists of this type were compiled by, e.g., Pollux (2nd CE) and Isidore of Saville (560–636 CE). For these see Bliquez (1984) 191 and Andorlini (2012). Galen’s and Erotian’s *Hippocratic Glossaries* are in a different category, being more than simple lists.

contain terms that appear to be still other names for instruments we know, e.g. *rhinospathion* or polyp knife, and terms that we may not properly understand, e.g. *kaulokluster* (penis irrigator?). While the purpose of these compilations remains uncertain, they surely derive from medical literature, and attest in a number of instances to names that must have been contained in texts that have not come down to us. In the body of this work I simply refer to these medieval productions as *Lists*.²¹

In fine, names for surgical tools and paraphernalia were abundant in the Greco-Roman world and there was a good deal of imprecision in their applications; hence my efforts to figure them out. Here too I hope to have improved on Milne; or, put another way in view of my debt to him, to have advanced his cause.

Surgeons: Training and Practice

Most practitioners will have learned their craft through apprenticeships, perhaps in conjunction with military service as recommended by the Hippocratic author of *Physician* (14P), or as reflected in the pharmaceutical careers of Scribonius Largus and Dioscorides.²² Observation and assistance will have been essential. Martial (*Epig.* 5.9) and Galen (*Aff. Parts* 8.192K) allude to students making ‘medical rounds’ with the master. St. John Chrysostom and other later Christian writers give vivid accounts of surgeries performed in public.²³ They may reflect similar earlier situations. Rich and ambitious aspirants, like Galen, could also attend lectures by prominent scholar physicians in places

21 There are altogether five such lists. The first, Laurentianus gr. 74, 2, was published in 1836 by Fr. R. Dietz. This was then incorporated and compared with a second (Paris lat. 11219, 9th cent., fol. 36 va–vb) by H. Schoene (1903). The names on these lists were explored by me in an essay on Byzantine surgery (Bliquez 1984). This in turn provoked a critical discussion of my views by K.-D. Fischer (1987). Significantly, Fischer was able to bring to bear on the study of these lists three more, unknown to me, from manuscripts in Bologna (ms. 3632, 15th cent., fol. 27v–28r), Copenhagen (Kgl. Bibliotek, Gamle Kgl. Samling 1653, 11th cent., fol. 74r) and Glasgow (Hunterian Mus., 96 = T 4. 13, 9/10th cent., fol. 49v). In addition to these five, I have also taken account of a sixth, included in the so-called *Hermeneumata Monacensia* (12th century, hereafter *Herm. Mon.*), which makes some useful equations of Greek and Latin medical terms.

22 For a handy synopsis of the careers of each, see their entries in Keyser and Irby-Massie (2008).

23 For these accounts see Bliquez (1984) 194.

like Cos or Alexandria, the latter of particular renown for surgical training.²⁴ Instruction likely involved readings from highly regarded treatises and dissection and vivisection, mainly of animals.²⁵ By later antiquity/early Byzantine times we can attempt, through the commentaries and compedia assembled in the 6th and 7th centuries by authorities like Aëtius of Amida, Stephanus of Athens and Paul of Aegina to construct a relatively detailed picture of training in the major centers, including the curriculum, methods of instruction, student-teacher relationships and hands on experience. Paul's *Epitome of Medicine* or *Pragmateia* with its heavy indebtedness to the huge corpus of Oribasius is useful in this respect. At one level it is a summary 'textbook' for instruction (συντόμου χάριν διδασκαλίας) of physicians practicing in rural areas or at sea,²⁶ but at another it allows us to consider what students were exposed to. The sixth book (which focuses on surgery and is basic to the present work) details chapter by chapter how to perform over a hundred and twenty operations, based on Paul's own and the experiences of his predecessors, often named.²⁷ In addition Paul here and there interjects first person observations,²⁸ and contrasts the methods of more recent practitioners ('The Moderns') to the ways of 'The Ancients.'²⁹ Since performing an operation after simply reading a text would be foolhardy, neophytes must have had access to hands on

-
- 24 Material remains can hint at medical associations. For example, the little hippopotamus with a uraeus used as a container among the Bingen instruments points to Alexandria; see Como (1925) 158(1–3), reproduced in Künzl (1983a) cover and 83(57.1–3). For negative opinion of Alexandrian surgeons in a late text see Fulgentius, *Mythol.* Preface p. 9 (Helm).
- 25 Galen mentions giving or dictating books to his students; *On His Own Books* 19.11–12K = Boudon-Millot 135–137. Instruction at, e.g., Alexandria in Galen's time may have occurred in houses as opposed to large scale establishments like the Museum; see Nutton (1995), esp. 17–20.
- 26 Preface 1.17–20.
- 27 Hippocrates (6.34.1; 6.79.1; 6.88.3), Galen (6.20.1; 6.37.1; 6.40.4), Antyllus (6.33.1; 6.40.3; 6.78.4), Leonides (6.32.1; 6.79.2); Marcellus (6.48); Soranus (6.96.1; 6.99.2).
- 28 Examples: 6.78.4 where Paul cannot follow Antyllus' directives for anal fistula; 6.8.3 where he notes two other ways of treating trichiasis; 6.27.1 where he stresses parulis can be cured by lancet alone; 6.65.4 where he acknowledges favorably alternative approaches to enterocele, 6.68.1, where he protests against being forced to castrate; and 6.90.10 for an instance of trepanning a head wound after a year. All such cases are based on personal observation or experience as is clear from his Preface, 1.1.25–26: "both things I saw done and have tried."
- 29 The contrast between 'The Moderns' (οἱ νεώτεροι) and 'The Ancients' (οἱ παλαιότεροι) is first drawn in the Preface 1.1.1–5. By 'Moderns' Paul seems to mean people roughly contemporary with and following Oribasius. See e.g., 6.62.2; 6.64.3; and 6.87.1 where Antyllus, Leonides and Galen are contrasted with 'The Moderns.' For other references, see 6.66.2;

experience.³⁰ This must have involved not just the proper use of instruments but also the application of bandages, dressings and plasters, such as Philotas of Amphissa's *kephalike*, used to seal wounds and set bones.³¹ Interestingly, over 25 of the surgeries Paul describes require 'assistants' (ὕπηρέται), as is the case in many interventions described by Oribasius, Aëtius and their sources, the role of these assistants being primarily to hold in position patients and their relevant body parts.³² Surely many, if not all, of these 'assistants' must have been student apprentices learning on the job.³³ Again, if we turn to Stephanus' *Commentaries on Hippocrates' Aphorisms* and *on Galen's Method of Healing to Glaucon*, we are offered an opportunity to transport ourselves virtually into the 'lecture hall.' There, with a little imagination, we can see the master expatiating critically (in light of his own practice) on selected texts of Hippocrates and Galen, while instructing his students what to do and what not to do in situations ranging from lancing empyema to the proper use of cups for hypermenorrhea.³⁴ Students fortunate enough to benefit by this type of instruction became professionals in the full sense of the word.

6.90.7; 6.99.5; 6.115.2. See also van der Eijk (2010) 523, "... *neoteroi*, doctors of later date than Galen."

- 30 I have made a similar argument for hands on experience in treating the surgical procedures Leon Iatrosophistes describes for his student George; see Bliquez (1999) 317.
- 31 See under Appendix: Materials, Sutures, Plugs, 'Tents', etc. Such plasters were classed as *raptousai* (sealing, sewing) and *enaimoi/a* (hemostats). For the fish glue (*ichthyokolla*) used in such a plaster see the entry *kephalike* in the Appendix at the end of this volume; for aristolochia (birthwort) as an *enaimos* see Scarborough (2011) 9.
- 32 Interventions range over angeology (6.5.1), relieving eye and throat conditions (6.8.1, 6.30.2), draining ascitis (6.50.2), repairing hernias (6.64.2), manipulating specula and embryo hooks (6.73.2; 6.74.2; also Soranus, *Gyn.* 4.9.2 & 10.3.2 Ilberg = 4.5.6 & 41 BGM) and skull and bone repair (6.90.4). Interestingly, Paul mentions 'assistants' more often than either Oribasius (15) or Aëtius (7) combined. In one case women are noted 'or certain/some assistants' (6.74.2). For Celsus, they are *ministeres* (7.19.7; 8.12.2); so also Muscio I 65, p. 22, II 34, p. 118.
- 33 So Scarborough (2010). Ὑπηρέται already appear in the *Hippocratic Corpus* (*In the Surgery* 3.2.2L) and in Plato, who calls them doctors. This indicates to him at least that their status was well above that of, e.g., a porter. Cf. *Laws* 4.720a: . . . ὑπηρέται τῶν ἱατρῶν, ἱατροῦς δὲ καλοῦμεν δήπου καὶ τούτους. Students appear in medical papyri of the late 1st century from Egypt: see Marganne (1998) 13–34, esp. 15 (τὸν μανθάνοντα). Galen uses similar language in referring to his students; *On His Own Books* 19.11–12K = Boudon-Millot 136–137 (τοῖς μαθηταῖς, τοῖς μαθησομένοις τὴν ἱατρικὴν τέχνην). We even find assistants (ὕπηρετεῖ) on a curse tablet directed against a legionary physician of the mid 3rd century; see *Supplementum Epigraphicum Graecum* 14.615 and Gager (1992) 171(79).
- 34 See Scarborough (2010).

However, in contrast to the rigorous training we see in Paul and Stephanus and that required by law in modern times, a Greco-Roman doctor could, quite literally, be anyone who considered him or herself to be such. There was no defined method of training or curriculum; nor did a person need to pass an examination, or be licensed to practice. Given these circumstances we are not surprised to hear of incompetents and quacks parading as healers.³⁵ On the other hand in the dedicatory lines of his first century work on compound drugs, Scribonius Largus bemoans the fact that in his time some non-members of the medical profession were more adept than professional doctors.³⁶ In the event of faulty or injurious treatment there was no legal code specifically designed to deal with malpractice, though an injured patient, or the relatives of one, might have legal recourse in other ways.³⁷

The *Hippocratic Corpus* gives glimpses of two types of doctors, those who moved from place to place and those who worked in and from, mainly their homes/'offices'.³⁸ Both types persist in the Roman world, the picture of the latter becoming considerably enlarged.³⁹ In addition, we can also trace the activity of practitioners at Roman fortresses, such as Neuss and Xanten, and now at the town of Allianoi (Western Turkey), where one particular building arranged around a courtyard represents either an early hospital or a surgical

35 As in: [Hippocrates] *Sacred Disease* 6.1.22–25L, Lucian, *Ignorant Bookseller* 29, and Galen, *On Prognosis* 14.621–23K (= *Corpus Medicorum Graecorum* V.8.1, 89–93, 178–180). The *Greek Anthology* has some wonderful poems ridiculing inept healers (see W.R. Paton's Loeb edition, vol. 4, 11.112–126). In the same vein see also Martial 1.47 and 5.9; Artemidorus Daldianus, *Oneirocritica* 4.2 (= p. 245, l. 20 Pack). For other references see Jackson (1995) 190.

36 *Animadvertimus itaque saepe inter deliberationes contentionesque medicorum auctoritate praecellentium, dum quaereretur, quidnam faciendum aut qua ratione succurrendum sit aegro, quosdam humiles quidem et alioquin ignotos, usu vero peritiores, vel (quod fateri pudet) longe summos a disciplina medicinae ac ne adfines quidem eius professioni, medicamento efficaci dato protinus vel praesenti numine omni dolore periculoque liberasse aegrum* (*Compositiones*, Ep. Ded. 1). See also Hamilton (1986).

37 Lucian, *Abdicatus/Disowned*, 4; Amundsen (1973).

38 As in the Hippocratic treatises *Epidemics* and *In the Surgery*. I doubt much in the way of serious surgical intervention was performed by priests of healing gods. Any operations we hear of in sanctuaries are miraculous events; e.g. Aelian, *Nature of Animals* 9.33.

39 For Roman urban healers Jackson (2009a) gives a full picture. For itinerants under the Empire see Galen, *Parts of Medicine* 2.3 = *Corpus Medicorum Graecorum* Suppl. Or. 2. p. 29. Oribasius (*Syn.*, Preface 3) thought that surgery was best practiced in settlements as opposed to on the road (ἐν ἀποδημίαις) because of the difficulty of securing the equipment and instruments needed.

clinic in which there may have been a sort of joint practice.⁴⁰ A curse tablet from Metapontum likely bears witness to an earlier such arrangement.⁴¹

Galen, of course, is a mine of information about the day-to-day doings of his own practice, especially where competition for the business of the Roman elite was concerned. For those who dealt with the less exalted, archaeological evidence comes to the fore. Here the houses at Pompeii and elsewhere may be taken as guides. As Künzl has observed, it is difficult to determine whether a grave find consists of a full or a partial instrumentarium. The same of course may be true at Pompeii, which was never the closed site it is sometimes asserted to be. But on the whole the surgical houses at Pompeii and the finds at Marcianopolis/Devnja (Bulgaria) and at Rimini, seem undisturbed.⁴²

At Pompeii tools, or at least evidence for them, have been traced back to over 20 locations (mainly houses) indicating that some degree of medicine/surgery was conducted on these sites.⁴³ In a few cases, such as the Casa del Medico Nuovo (II), the instrumentaria were extensive, leading to the conclusion that those who employed them were full or nearly full time practitioners.⁴⁴ Smaller instrumentaria suggest part time practice. The latter consist of basic tools: scalpel, sharp retractor, forceps, needle/probe, and spatula.⁴⁵ Many, if not most operations could be performed with just these multipurpose instruments.⁴⁶ Portable kits like that found in the 'Piazza del Anfiteatro' in Pompeii, the grave at Wehringen, Bavaria, and more recently at Herculaneum are representative examples.⁴⁷ When pharmacy is central to a practice, one finds emphasis on spatulas, ligulas, spoons, drug containers and grinding stones.⁴⁸

40 For Alliano see Baykan (2012) with Nutton's review (2014). The courtyard complex provided the richest find of the instruments recovered and catalogued. Based on their distribution Professor Baykan sees individual rooms of the courtyard complex given over to various specialties, such as urology and ophthalmology. The building is only partially excavated. The instruments found there are dated 75–250 CE.

41 For this *ergasterion* or "workplace" of the late 4th–early 3rd cent. BCE see Gager (1992) 172–173(81) and Nutton (1995) esp. 14–16.

42 Jackson (2002) 91.

43 Bliquez, Jackson (1994) 78–96.

44 Bliquez, Jackson (1994) 84.

45 These items might be expanded to include a cautery and a cupping vessel: see Jackson (1995) 193 & (2002) 91; Künzl (1993).

46 Celsus 7.4 (fistula), 7.7.7 (aegilops), 7.12.2 (tonsillectomy), 7.12.3 (uvulectomy) may serve as random examples.

47 Bliquez, Jackson (1994) 87–8; Künzl (1983a) 120–1, De Carolis (1993).

48 As in reports on the 'Farmacia' in Pompeii; see Bliquez, Jackson (1994) 89.

It is uncertain who the Pompeian practitioners were in each case.⁴⁹ The names of the many doctors that surface in the literature are Greek, and the rancorous testimony of Pliny and other authors leads in the same direction: medicine in the Roman world was primarily a Greek business.⁵⁰ A practitioner was, therefore, often a Greek, or at least a Greek speaker, and, probably, a slave or a freedman; on occasion he might even be the self-sufficient master of the house envisaged by Celsus and Pliny.⁵¹ This means that in general the social status of a 'Roman' surgeon at Pompeii and elsewhere in the Empire will not have been high.⁵² So, while in some instances at Pompeii the practitioner may have owned a house, most likely this healer was in the employ of the owner/master. In three houses at Pompeii, the presence of specula, birthing hooks and douches bear witness to specialization in gynecology and obstetrics (Bliquez [1995]). There is ample testimony in texts and inscriptions to female practitioners, mostly in connection with gynecology; so we cannot conclude that those who operated these Pompeian tools were necessarily always men.⁵³

In larger cities with extensive populations specialists were generally available. As early as the *Hippocratic Oath* (4.17L) we hear of lithotomists. Galen in a treatise that only comes down to us in Arabic and Latin mentions practitioners of dentistry, otology, proctology, and ophthalmology.⁵⁴ The titles given to physicians in literary texts and on gravestones, such as *medicus ocularius*, *medicus chirurgus*, *vulnerarius*, *chirurgicus venarius*, etc. likewise attest specialization.⁵⁵ Among specifically surgical specialists Galen mentions dentists, oculists, otologists, couchers of cataracts, proctologists, and surgeons for hernias and bladder stone, while Martial (*Epig.* 10.56) alludes to a dentist and an

49 We know the name of only one, A. Pumponius Magonianus. His name smacks of a freedman. See Van der Poel (1977–) pars 2, 301, Della Corte (1965) 192, nr. 459, and Bliquez, Jackson (1994) 81.

50 Nutton (2004) 157–170.

51 Scarborough (1969) 94–109, Jackson (1988) 10.

52 Pleket (1995) 27–34.

53 Nutton (2004) 196–198.

54 *Recognizing the Best Physician* 10 = *Corpus Medicorum Graecorum* Suppl. Or. 4. pp. 116–19.10. See also, Justinian, *Digest*, 50.13.1.3 for specialists in treating fistula: *Medicos fortassis quis accipiet etiam eos qui alicuius partis corporis vel certi doloris sanitatem pollicentur: ut puta si auricularis si fistulae vel dentium*. For a summary of eye conditions that were treated surgically, see Jackson (1996) 2243–2250.

55 Celsus 6.6.8 (Euelpides, *maximus ocularius*); Andre (1987) 59–71; Korpela (1987); Jackson (1993) and (1995) 191.

expert in uvulectomy.⁵⁶ Cicero (*De Orat.* 3.132) and Martial also seem to tell us of those who concentrated on wounds.⁵⁷ Instrumentaria from Roman graves especially, but also from houses, reflect the specialties detailed in the *Oath* and Galen. Of extensive ensembles already named, those recovered in the grave of the Bingen surgeon and the Domus 'del chirurgo' at Rimini are weighted toward bone surgery, while that from Asia Minor contains appropriate equipment for lithotomy and eye surgery.⁵⁸ The latter is surely emphasized in a long known instrumentarium from Rheims and a more recent find at Montbellet.⁵⁹ Dental forceps prevail in sets found at Wederath and Gadara,⁶⁰ while instruments for throat conditions predominate in a set in Bristol.⁶¹ We have already mentioned the tools for gynecology/obstetrics at three Pompeian sites, best documented by the Casa del Medico Nuovo 11. Sets from Kallion and St. Privat d'Allier contain tooth forceps among other instruments, showing that doctors might be dentists as well.⁶²

Design and Manufacture of Tools

Pompeii also provides at least one establishment where, in addition to other wares, surgical tools of metal were made.⁶³ A trivalve speculum has also been recovered in a shop in Dion, Greece where the excavator thinks it was brought for repair.⁶⁴ These sites are few but they accord with statements in Galen, which attest the role of craftsmen in the manufacture of instruments, and with reliefs showing the common scalpel displayed in metalworkers' shops' among other

56 Galen, *Parts of Medicine* 2.2 = *Corpus Medicorum Graecorum* Suppl. Or. 2., 27–29; Galen, *Thrasylbulus, Is Health Med. or Gymn.*? 5.846 & 850K. For a practitioner operating on the dark side, consider Heliodorus the Castrator (Juvenal 6.373).

57 Cicero: *medicos . . . qui . . . vulneribus . . . mederentur*. Martial (*Epig.* 10.56.5): *tristia saxorum stigmata delet Eros*. Shackleton Bailey would read *servorum* in place of *saxorum*, in which case Eros specialized in removing a slave's branded scar.

58 For other instrumentaria reflecting lithotomy see Jackson (2010).

59 Deneffe (1896); Feugère, Künzl, Weisser (1985).

60 Künzl (1983a) 71; Künzl, Weber (1991).

61 Jackson (1992) 178.

62 Künzl (1983a) 42(11.1), 58(26.4–5) and Jackson (1995) 196–200 who provides a full list with a statistical breakdown.

63 Bliquez, Jackson (1994) 83–84.

64 Pantermalis (1997); Bouzakis, Pantermalis (2008).

items exhibited for sale.⁶⁵ Since the common scalpel and other articles like spatulas, spoons, the *dipyrene*, and tweezers were as apt to be employed by a layperson as by a physician-surgeon, blacksmiths ordinarily could render them independently. But what of more specialized tools like specula or altogether new forms? It is clear that Hippocratics often created or got made their own equipment on the spot, a good example being the special obeliscoid cauterics mentioned in *Hemorrhoids* 3.31L for burning piles, or the iron bone elevators recommended in *Fractures* 3.31L. By the Hellenistic age we have personal names associated with tools. For example, Meges' lithotomy knife and Erasistratus' invention or improvement of the male catheter draws these famous individuals into the development of instruments.⁶⁶ These contributions dovetail with the recently recovered letter/treatise by Galen entitled *Avoiding Distress* (Περὶ ἀλυπησίας). In dealing with materials he lost in the fire that swept through the Forum of Peace and the Sacred Way at Rome (192 CE), Galen speaks of his personal role designing and submitting models for new instrument types for smiths to execute.

<You said> you were surprised, not because I was seen enduring without grief the loss in the fire of the silver, gold, silverware and numerous contracts that were kept there, but rather because I also was seen enduring the loss of a great quantity of my writings there, as well as a wide selection of varied medicines, both simple and compound, and instruments of all kinds: tools well adapted to medicine, that I said I had lost but was still hoping to acquire (= go back and recover?), and tools that I had invented, for which I made wax models that I regularly gave blacksmiths to forge, so that I can't get new ones without much time and effort.⁶⁷

65 Galen, *Comm. Hipp. Epidem.* 6, 17b.229K = Wenkebach pp. 256–257: οὕτως οὖν καὶ τῷ ἱατρῷ πολλὰ τέχναι παρασκευάζουσι <τὰ ὄργανα καὶ> τὰς ἐπιτηδείους ὕλας . . . For the reliefs showing the shops of L. Cornelius Atimetus, Verrius Euhelpistus and other representations see Krug (2008) 27–31.

66 Celsus 7.26.2N; Pseudo-Galen, *Intro. or Physician* 14.751K = Petit 13.35.

67 θαυμάζειν οὐχ ὅτι καὶ ἀργυρίου καὶ χρυσίου καὶ ἀργυρωμάτων καὶ συμβολαίων πο <λ>λῶν ἀποκειμένων ἃ διεφθάρη κατὰ τὴν πυρκαϊάν ἀλύπως ωφθῇ <ν> φέρων, ἀλλ' ὅτι πλῆθος ἄλλο τῶν ὑπ' ἐμοῦ συ<γγε>γρα<μ>ένων αὐτοῦ, φάρμακα δὲ παντοῖα πάμπο<λ>λα, τὰ μὲν ἀπλᾶ, τὰ δὲ συγκείμενα, καὶ ἄρμενα παντοδαπά, τὰ μὲν εἰς τὰς ἱατρικὰς ἐπιτήδεια χρεῖας <ᾶ> μὲν οὖν ἔφην ἀπολέσας ἀλλὰ κτήσασθαι ἔτι ἐλπίζει <ν>, τὰ δὲ ὑπ' ἐμοῦ [χρήματα] προσευρημένα [τῶν ἀρμένων] ὧν τὰ ὑποδείγματα πλάτ<τ>ων αὐτὸς ἐκ κηροῦ τοῖς χαλκεύσιν ἐδίδουν, ὥς οὐκ ἔτ' οἶόν τε σχεῖν ἄνευ χρόνου πο<λ>λοῦ τε καὶ ἀσχολίας μεγάλης . . . (4–5 Budé text). See too the recent translation by Vivian Nutton (in Singer [2013] 79). This passage is discussed by Andorlini (2012) in relation to an *Oxyrhynchus Papyrus* (LIX 4001), where an Egyptian

This valuable passage relates to long known inscriptions from Ephesus dating to the reign of Antoninus Pius. These record competitions in instrument design as a regular feature of the local medical culture.⁶⁸ One can also cite Galen, *Cmpds. by Place* 12.871–872 where Heracleides of Tarentum (or perhaps Asclepiades) makes up a special file for leveling teeth.⁶⁹ That some of these designs became notable is likely in view of the testimonia in the literature to the ‘virtuoso’ instruments mentioned above, not to mention Heron’s association with the syringe he called *puoulkos* (see s.v. under Tubes).

Other than the Pompeian shop noticed above, it has so far been impossible to trace individual tools back to the workplaces where they were made. In some cases, we at least know the name of a smith who made or might have made such instruments, while in others the similarity in form or décor of tools allows us to suggest a common origin without greater specificity.⁷⁰

Materials, Characteristics, and Quality of Tools and Paraphernalia

In the main, surviving instrumentaria provide us with tools and containers made of copper alloy; that is, of bronze or brass. Characteristic of these tools is that many are equipped with an instrument at each terminus; that is to say, they feature two instruments in one tool. Spatulas and Spoons, for example, are complemented with olivary enlargements used for grinding, probing and cauterizing, while scalpel blades protrude opposite blunt dissectors, needles opposite retractors, etc. The purpose of these combinations is not specifically remarked upon in the literature; but it is easy to see that they would serve to facilitate an operation or procedure where both ends could be brought to bear and, at the same time, conserve metal. Facilitation is particularly obvious in the case of the common scalpel-dissector combination, as well as in the

physician asks that instruments (ἄρμενα) be sent him, so that he can make others. If we are to take his language literally, he intends to make these himself (ἵνα ποιήσω). Compare Galen, *Cmpds. by Place* 12.871K... σιδήριον ἐποίησα ῥινίον ὡς ἐνεργεῖν ταχέως. See, in addition, *Thrasybulus, Is Health Med. or Gymn.*? 5.890K... τὴν μὲν σμίλιν ἢ χαλκευτική... and the following passages from *Anatomical Procedures* where Galen probably employs smiths to execute his designs for special tools: 2.682K (dissecting the spinal canal διὰ τινος ὑπ’ ἐμοῦ κατεσκευασμένου παραπλησίως τῷ καλουμένῳ σκολοπομαχαίρῳ) and 2.708–9K (cutting away the flesh on ox heads ἐκκοπεῦσι τοῖς ἰσχυροῖς χρώμενος, ἢ τοῖς τῶν τεκτόνων σκεπάροισι, ἅπερ ὁρᾷτε καὶ μοὶ προπαρεσκευασμένα).

68 Engelman, Knibbe, Merkelbach (1980) 108–112 (nos. 1161–69).

69 σιδήριον ἐποίησα ῥινίον...

70 Künzl (1984a); Jackson (2009b) 74–76, 86–87.

blade-retractor and blade-scoop combinations on lithotomy and polyp knives respectively.

The blades of cutting and puncturing instruments like scalpels, needles, and chisels were of iron or steel bonded with tin and lead solder into slots.⁷¹ In the case of scalpels slots characteristically took the form of keyholes. In *Antomical Procedures* Galen expresses his preference for the steel from Noricum, and insists on the hardest iron for his chisels.⁷² Though some blades survive intact, most have rusted away over time. This was surely the fate of iron/steel needles and most cauteries of iron.⁷³ While cauteries are richly attested in the literature, very few iron types are preserved. Blobs of iron clinging to copper alloy instruments recovered in Pompeii are perhaps the remnants of what may be lost specimens.⁷⁴ More substantial iron forms like tooth forceps, the arms of levers, a few shears and the blades of some chisels fare better. Fine copper hooks, needles and probes too are often gone or badly corroded. Tin and lead probes and tubes, though mentioned in the literature, are also seldom found in surviving instrumentaria, indicating that these may have been rarely used. Gone too are the leather pouches and portable wooden cases with separators for storing scalpels and levers, such as are depicted on a stone dedication from the West Slope of the Acropolis now in the Athens Museum, the tombstone of Publius Aelius Pius Curtianus from Palestrina, a sarcophagus in New York, and a recently published relief in Berlin.⁷⁵ In contrast, cylindrical cases of copper

71 For scalpels see Krug (1993) and Jackson (1986) 133–135. The Rimini find now makes it clear that surgical blades were also inserted into tubular sockets; these had been assumed to be for, e.g., needles, birthing hooks, and chisels. Slots (including the keyhole type) also were used on levers at Pompeii (Bliquez, Jackson 1991 131.93 & 206 A19) and Bingen (Künzl 1983a 82.10–13 = Fig. 52). Again, slots were used to fasten the iron jaws of a forceps to a copper spring handle (Musée d'Archéologie nationale, Saint-Germain-en-Laye, Inv. No. 35473) and the iron blades of shears to a copper spring handle (as in the instrumentarium from Nijmegen, Leiden, Rijksmuseum van Oudheden, Inv. No. NHa1, shown in Fig. 89). For a surprising number of iron/steel instruments in one kit, see Jackson (1997a) for the recent discovery at Stanway, Essex.

72 2.709K = 11.553Gar: πρὸ πάντων δ' ἐκ σιδήρου σκληροῦ κατεσκευάσθω τὰ τοιαῦτα (chisels): τὰ γὰρ ἐξ ἀσθενοῦς ἐπὶ πολλαῖς πληγαῖς ἀνύσει τι σμικρόν; 2.682K = 11.521Gar: <ἐκ> σιδήρου δὲ ἔστω τοῦτο (a knife for dissecting along the spine) τοῦ καλλίστου, οἷον περ τὸ Νωρικόν ἐστιν, ἵνα μήτ' ἀμβλύνηται ταχέως, μήτ' ἀνακάμπτηται ἢ θραύηται; see also Horace, *Epodes* 17.71 (*ense... Norico*).

73 A needle can still be seen turned back on its socketed holder at Pompeii; Bliquez, Jackson (1994) 54, 165(227).

74 E.g., Bliquez, Jackson (1994) 126(71–72).

75 For P. Aelius Pius Curtianus see Scarborough (1969) pl. 14 and Tabanelli (1958) Pls. XIII–XIV; For Athens see Milne (1907) pl. IV, Jackson (1988) 115; for New York, Jackson (1988) 73.

alloy used as containers for instruments mounted on shafts and for drugs survive in abundance. Boxes of the same material, many compartmentalized, some featuring fine decor, also occur in lesser numbers. For these cylinders and boxes see below under Vessels/Containers.

Biodegradable material like the leather used for wedges, the linen, wool and papyrus applied as compresses, plugs/pledgets and bandages, the reeds used for insufflation, the feathers deployed for swabbing, and the bristles for probing are all gone.⁷⁶ On the other hand there are occasional survivals of bone probes and boxes, glass and clay bowls, beakers and jars, even wooden probes and containers.⁷⁷

As to manufacture, tools were rendered by casting, forging and cold work. Substantial forms of copper alloy, such as scalpel handles and sequestrum forceps, were cast in molds by the lost wax or investment process,⁷⁸ while catheters and tubes were cut, beaten and twisted into shape from sheeting;⁷⁹ iron/steel instruments and components like blades were forged.⁸⁰ It is unclear whether lathes (τόρνος/*tornus*) or just chisels were used to create the threading of the worms on specula (Figg. 70–72), and the threaded shafts of some spoon probes and needles (Fig. 2, bottom row 8th & 12th from rt.; Fig. 30).⁸¹ Most

These stones and more are conveniently assembled by Krug (2008). For speculation on the wood used in cases of this type see Jackson (1986) 135 n. 33.

- 76 Even fingers were used as instruments: Celsus 7.21.1, 26.2K, & 27.8; Galen, *Anat. Proc.* 2.247K = 1.35–37Gar; Theodorus Priscianus, *Ant. Br.* 42 (Rose); Paul 3.76.3.
- 77 For a bone clyster, see *Notizie degli scavi di Antichità* = *Atti della R. Accademia Nazionale dei Lincei* (1901) 143; for bone handles for knives, see Künzl 1983a 9(5–6); for glass containers Caton (1914) 118(xvi) and Künzl (1983a) 92(70–72), 94(74) = Figg. 86–87, 89; for a wooden (perhaps pine) tourniquet (?), see Gibbons (1989); for wooden medicine/drug containers, see Künzl (1983a) 95(76) = Fig. 89 and Spawforth (1990) 9–10.
- 78 Nutton's note (in Singer [2013] 79) provides a handy simple description on how the lost wax process would have been used to execute Galen's designs.
- 79 Note the open seam on the male catheter from Colophon and the Smithsonian tube (Figg. 57b & 59a–b).
- 80 Longfield Jones (1978), Krug (1993), Jackson (2009b), 74, 86–87, Jakielski, Notis ([2000] esp. p. 387) give a thorough analysis of the metal composition and manufacturing process of an ear scoop and a spatula. They find that the former was a brass cast in one piece, the latter a worked copper rod mounted by a bronze spatula cut from a sheet that was cast and then hammered flat; rod and spatula were then linked by lead solder. The tools analysed were probably not surgical, as the authors assume, but their analysis will apply just as well to scoops and spatulas that were.
- 81 See Museum Würth (1995) 43. The treatment of the worms on uterine specula featured in this marvelously illustrated exhibition catalogue depends on the views of Alfred Mutz who, owing to the precision of the threading and other considerations, inclines to the lathe (180–186). Mutz holds that the worms on the Pompeian trivalves are comprised of

likely both were employed. The superior craftsmanship involved is evidenced by skillfully turned handles on scalpels (Fig. 52.9), and by the rings and baluster and doorknob finials on retractors and forceps (Fig. 2, bottom row, far left; Fig. 3, middle row, 4th, 5th and 7th from rt.). Some pieces feature damascening or inlay in silver (Fig. 15), or niello or Corinthian Bronze.⁸² These recall the references to gold and silver instruments in a jibe at incompetent doctors made by the 2nd century satirist Lucian.⁸³ One is struck by the aesthetic care expended on Greco-Roman instruments as opposed to those produced in modern times. The reason would seem to be that instruments were of particular importance in marking out and elevating the status of a physician;⁸⁴ thus, in an age where inconsistent or ineffective use of antiseptics and anesthetics made surgery a treatment of last resort, fancy gear must have inspired confidence.⁸⁵

In addition to molded rings and finials decor may consist of abstract lattice patterns and striation; or of recognizable motives, like acanthus and ivy leaves (Fig. 15), the head of a snake (Fig. 38.1; Fig. 1, middle row, 1st and 3rd from rt. and Figg. 71–72), or a wolf, or the bust of the god/hero Hercules (Fig. 2, top row, 6th, 7th, & 9th from rt.; Fig. 13). These motives likely helped to secure the surgeon's grip; but in many such cases the motif has recognizable symbolic value. Pliny the Elder refers to ivy as *medicatissima*, or 'extremely medicinal.'⁸⁶ Ivy was mixed with wine, for example, for oral administration and as a plaster;⁸⁷ but perhaps we find it on, e.g., scalpels (as Fig. 15) because its vigorous growth is suggestive of life and survival. Clearer in meaning is the snake or a cock, both of which signify the healing presence of Asclepius,⁸⁸ while the wolf's

brass, its zinc and tin combined in a wrought alloy, not cast; see his article "Römische Bronzegevinde," *Technikgeschichte* 36.2 (1969) 163–164. This is also true of the Wellcome specimen; Longfield Jones (1978) 84. Bouzakis-Pantermalis (2008) do not take account of Mutz' findings and hold to casting by lost wax, relying on computer tomography. They present a clever theory how the thread of a worm might have been designed by rolling a cylindrical model of wax over a filament positioned at an angle to it (641–642).

82 Krunić (1995).

83 Lucian, *Ind.* 29.

84 See Herodotus 3.131. The close association is found even in animal fable; see B.E. Perry, *Aesopica* 1 (Urbana: U. of Illinois Press [1952]) 324(7).

85 With no proper understanding of the cause of infection, cleanliness of person and instruments was appreciated mainly for aesthetic purposes: [Hippocrates] *Physician* 1P. That metal salts were sometimes available and used as antiseptics is clear; see Foster, Kanada, Michaelides (1988) for the picture in Cyprus. Of course, the copper salts and corrosion products on instruments could also play a role as anti-bacterial agents.

86 *Nat. Hist.* 28.79,

87 Pliny, *Nat. Hist.* 24.75–80; Dioscorides, *Mat. Med.* 2.179.

88 For Asclepius, Asclepius with Hygieia, and Asclepius' snake, see Künzl (1996) 2634–2636 and Sobel (1991) 124–125(1–3), 142(26). For a terracotta cock in a grave from Bonn with an

head reflects Apollo Lykios, therefore Apollo Medicus, father of Aesculapius.⁸⁹ Hercules and his knotty club and lion skin suggest endurance in the face of suffering (in addition to busts see Fig. 20, 1st & 5th from left; Fig. 37).⁹⁰ At least four scalpel handles representing Hercules have been found at Pompeii and further specimens have surfaced at Corinth and in Jerusalem.⁹¹ The Corinthian piece is of particular interest. It is recorded as having been recovered in Byzantine levels. If so, a tool that may date to the first century was still being used many centuries later, an indication how long the active life of these tools could be.⁹²

How Successful were the Surgeries?

Finally we may ask what expectations a patient might have that surgery would improve his/her situation. Of drugs diet, and surgery Celsus regarded the last as most obvious (*evidentissimus*) in its effects, but also as a measure of last resort.⁹³ It is easy to understand why. Even though non-emergency surgery would have been performed in establishments with a ready water supply, such as houses and baths, without modern hygienic procedures, infection and sepsis must always have been a danger.⁹⁴ Then too we can only wonder how effectively anesthetics and analgesics were employed. On the one hand, it is clear that the ancients were well aware that narcotics such as mandrake, hyoscyamus (henbane), thornapple (datura) and opium functioned as analgesics and anesthetics.⁹⁵ Mandrake in particular is cited by a number of authors in connection with surgical operations. Dioscorides, for example, provides a full account of its preparation, application and effects, remarking in part:

ointment slab and oculist's stamps, see Künzl (1983a) 87(62). The snake is particularly popular on uterine specula (Figg. 71 & 72).

89 Künzl (1993) 99–100.

90 Bliquez (1992) and Bliquez, Jackson (1994) 99–106.

91 Bliquez (1999) 296–297.

92 Davidson (1952) 191(1406). For a small instrumentarium that may contain tools made both earlier and later in the Empire see Künzl (1993).

93 Prologue to Book 7; for surgery as a last resort, see also Seneca, *On Anger* 1. 6. 2, Galen, *Recognizing the Best Physician* 10.2, and the Empress Livia's remarks to Augustus in Dio, *Roman History* 55.17.1.

94 For finds of surgical instruments in bathing complexes at Xanten, Trier, and Weissenburg, see Künzl (1986a); for a pair of catheters in the spa at Baden, see Jackson (1999) 112.

95 For much more detail, see Cavenaile (2001) and Scarborough (2012a). There is in addition a vague reference to a local anesthetic for mastectomy in *Physica Plinii Bambergensis* 67.2.

... some say that (another kind of mandrake) puts one to sleep when as little as a drachma is consumed in a drink, or when eaten in a barley-cake, or when eaten in [any] prepared food. The individual falls asleep in whatever position he might have been in, when he ate it, and then feels nothing for three or four hours from the time he takes it. Physicians about to perform surgery or apply the cautery use this also (tr. Scarborough, "Hernia Repair in Roman and Byzantine Surgery" [forthcoming], note 107).⁹⁶

Galen in *Cmpds. by Place* 13.93K provides an attention getting recipe for an analgesic which surely also functioned as a surgical anesthetic. He ascribes this 'pain relieving potion' to Rufus of Ephesus and says he uses it himself.⁹⁷ Among its ingredients we find bark of mandrake (μανδραγόρου φλοιού), seeds of hebane (ύοσκυάμου σπέρματος) and latex of opium (όποϋ μήκωνος). Such a combination of narcotics suggests that anesthetics were more effective when administered in cocktails.

On the other hand Celsus gives the impression anesthetics were not used. In treating of the ideal surgeon (*chirurgus*), he wants him to be relatively young, steady of hand, capable of operating ambidexterously, clear of vision, undaunted of spirit and:

... filled with pity, so that he wishes to cure his patient, yet is not moved by his cries, to go too fast, or cut less than is necessary; but he does everything just as if the cries of pain cause him no emotion (tr. Spencer).⁹⁸

Celsus is not alone in this regard. We also find references to surgically induced pain before and after his time in the *Hippocratic Corpus* and in Patristic literature.⁹⁹ Still, it is hard to believe that in major operations like hernia repair, where intense pain would lead to shock, narcotics, singly or in cocktails, were not employed. The picture seems muddled: clearly there were functional

96 *Mat. Med.* 4.75.7: ἱστοροῦσι δέ τινες καὶ ἐτέραν μώριον ... ἦν φασι πινομένην ὅσον δραχμὴν μίαν ἢ μετ' ἀλφίτου ἐσθιομένην ἐν μάχῃ ἢ ὕψω ἀπομωροῦν· καθεύδει γὰρ ὁ ἄνθρωπος ἐν ᾧ περ ἂν φάγη σχήματι αἰσθανόμενος οὐδενὸς ἐπὶ ὥρας τρεῖς ἢ τέσσαρας, ἀφ' οὗ ἂν προσενέγκηται. χρώνται δὲ καὶ ταῦτῃ οἱ ἱατροὶ ὅταν τέμνουν ἢ καίειν μέλλωσι. Cf. also Pliny, *Nat. Hist.* 25.150; Isidore of Seville, *Etymologiae*, xvii, 30 [ed. André].

97 ἀνώδυνον πότιμα ᾧ χρῶμαι παρὰ Ρούφου ... I owe the reference to John Scarborough.

98 7 Proemium 4: .. *misericos sic, ut sanari velit eum, quem accepit, non ut clamore eius motus vel magis quam res desiderat properet, vel minus quam necesse est secet; sed perinde faciat omnia, ac si nullus ex vagitibus alterius adfectus oriatur.*

99 [Hippocrates] *Physician* 5P and *Hemorrhoids* 2P; St. John Chrysostom, *On the Paralytic let down through the Roof*, in J.-P. Migne, ed., *Patrologia Graeca* 51, col. 51; and Plutarch, *Marius*, 6.3. Lucian seems to allude to surgical pain in *Apol.* 2.

anesthetics, but they may not always have been easy to use safely; thus, either pain relievers were not always used, as in lesser interventions for nasal polyp, hemorrhoids, etc., or they might not always have been administered effectively. All told it would seem that, depending on the circumstances, surgery could be painful and, considering its everpresent complications, always risky. Perhaps for this reason Galen did not identify himself as a surgeon, even though it is clear that he performed operations.¹⁰⁰ So, however *evidentissimus* in its effects surgery was to Celsus, it is not obvious to us just how effective surgery was, and some might doubt it was very effective at all.¹⁰¹ On the other hand we occasionally hear of remarkable successes; for example, Galen's removal of the suppurating breastbone of Marullus' slave.¹⁰² While one might counter that these instances were remarkable precisely because they were successful, it is a fact that the procedures to be followed for major operations are described over and over in Celsus, Galen, the Roman practitioners who are excerpted in the handbooks of Oribasius, Aëtius, Paul and, furthermore, by Byzantines like Leon Iatrosophistes. To me this is evidence that these surgeries were successful often enough to merit their continued employment. Practice makes perfect and the existence of specialists, both as attested in the literature and as evidenced by some instrument sets, allows for an argument to be made on the positive side, in spite of the absence of statistical data.¹⁰³

100 Note how Galen distinguishes himself from those called surgeons (τοῖς χειρουργοῖς καλούμενοις) who perform trepanning/trephining; *Meth. Healing* 10.454–5K = J-H 2.234–235. For Galen's surgeries and anatomical work, see Toledo Pereyra (1973).

101 Jackson (2002) 93 is right to emphasize the role of chance in the rate of success. Still, I may be a bit more optimistic.

102 *Anat. Proc.* 2.631–633K = 11.457–461Gar, *Opinions of Hippocrates and Plato* 1.5.1–5 = *Corpus Medicorum Graecorum* 5.4.1, pp. 73–77. It is unclear how many gladiators Galen saved from their wounds but clearly enough to keep him employed; *Recognizing the Best Physician* 9.4–7, *Corpus Medicorum Graecorum* Supp. Or. 4.102–5, and *Cmpds. by Kind* 13.599ff.K. We know of one case of gastrorrhaphia in Cleanthes' attempt to replace Cato's bowels and sew up the wound. This was unfortunately frustrated by Cato himself; Plutarch, *Cato Minor* 70.

103 [Hippocrates] *Breaths* 6.1.12–13L. In addition to general references to specialties like lithotomy, we sometimes find a surgeon identified by his practice: e.g. Ammonius the Lithotomist (Celsus 7.26.3B), Achilles the Cataract Coucher or Dropsy Tapper (Galen, *Cmpds. by Place* 13.90K).

Hippocratic Surgeries and Surgical Tools¹

We first find descriptions of surgical procedures in the Hippocratic works of the later 5th and the 4th century BCE. Clearly, however, many of these operations were practiced long before they were actually recorded. Depiction of cupping vessels on a grave monument of the early 5th century BCE and the recovery of cups matching the depiction (see below) are material evidence for at least this intervention, well before its attestation in Hippocratic literature. Whereas an Homeric healer might proceed with an incantation or magic herb or potion (e.g. *Iliad* 4.217–19; *Odyssey* 19.455–58), Herodotus' account of the renowned Democedes of Croton (3.131), said to have carried on without any tools at all, shows indirectly that physicians were expected to be equipped with an instrumentarium by the last quarter of the 6th century.

The *Hippocratic Corpus* is rich in the names of instruments as well as in descriptions of their shapes and functions. This contrasts sharply with the dearth of material survivals from the period in which the bulk of the *Corpus* was written; hence the central role of texts and the names they contain. In fact, the only instruments currently available that can be recognized as 'Hippocratic' are a number of cupping vessels, which, so far as is known, were recovered from graves. Graves, of course, are our chief material source for the instruments used by Greco-Roman practitioners. However, graves containing tools are in the main confined chronologically to the period of the Roman Empire; only then, it seems, did it occasionally happen that a deceased physician was buried with some or all of his instrumentarium. Still, in basic respects most Hippocratic instruments will not have differed appreciably from their Roman successors: a forceps is, after all, a forceps, and a cupping vessel, a cupping vessel. The corresponding Roman types can be found with illustrations under the appropriate sections of Tools of the Empire.

We can glean a few generalities about the Hippocratic instrumentarium from the surviving *Corpus* of Hippocratic writings. The author of *Physician* 2P states that all instruments should be well fitted for their use in size, weight, and fineness; furthermore, he stresses that copper alloy should be used only for them, as opposed to other equipment a doctor might have.² From *Use of*

¹ An earlier version of this chapter appeared under the title "The Hippocratic Surgical Instrumentarium, a Study in Nomenclature," in *Medicina nei Secoli* 15/3 (2003) 403–440.

² Χαλκώματι δὲ πλὴν τῶν ὀργάνων μηδὲνι χρῆσθω.

Liquids 1P we learn that potable water is best for instruments of iron/steel and copper alloy (ποτὸν—σιδηρίοισι καὶ χαλκείοισι κράτιστον).³

These passages are particularly valuable, not just for information on how Hippocratic instruments were kept clean (and perhaps ritualistically pure) but as attesting the primary materials of which they were made. The only testimony to storage of the tools is found in *Decorum* 9.8.8–9L where the physician is urged to have at hand a portable carrying case of the simpler type called *parexodos* (παρέξοδος ἢ λιτοτέρη—ἢ διὰ χειρέων) for making his rounds (πρὸς τὰς ἀποδημίας). *Decorum* may be a later work,⁴ but clearly instruments permanently at hand were every bit as valuable to the Hippocratic as to his successors and were, therefore, properly stored in the more elaborate cases that are presupposed in this passage. Likewise, it is very much in keeping with the world of *Epidemics* that some tools were ready packed in simple containers for work away from ‘the office.’ The term *parexodos* or ‘that brought away on the road’ is an appropriate name for just such a traveling kit.

It is possible that another Hippocratic name for the *parexodos* was *kulichnis* (κυλινθίς). The name likely designated a container for instruments in the 3rd century BCE, as it occurs, several times in conjunction with a probe (μήλη), among the inscribed dedications to Asclepius in Athens.⁵ It could, therefore, have existed in this sense earlier. In fact *kulichnis* may actually have occurred in the *Hippocratic Corpus*. The case rests on Galen’s *Hippocratic Glossary* where the word κυγχνίδα is defined as a small cup or container used by doctors (κυγχνίδα· τὴν τε σμικρὰν κύλικα καὶ τὴν ἰατρικὴν πιθάκην).⁶ If κυγχνίδα is a corrupt form of κυλινθίδα (so Foës)⁷ then *kulichnis* did occur somewhere in Hippocratic literature. Unfortunately, even if this is the case, it’s precise meaning remains uncertain.⁸

3 As the smelting of iron and rendering of steel is described in *Diseases* 4 (7.55.29–35L) and *Regimen* 1.13Joly-Byl, keen blades of steel should have been available for the Hippocratic practitioner.

4 See the remarks of W.H.S. Jones’ in his introduction to *Decorum* in the second volume of the Loeb edition of Hippocrates, pp. 269–271 and those of J.L. Heiberg in *Corpus Medicorum Graecorum* 1.1.1. (1927), pp. 25–29.

5 IG II² 1534B and 1535, lines 155 and 161 (244/3 BCE), as presented in Aleshire (1989) 263–264. See also p. 332 of the same work.

6 19.115K.

7 See M.J. Milne (1939) 284.

8 Aristophanes, *Knights* 906 and schol. (repeated by Suda, *Lexicon* kappa.2668) makes it a container for drugs or medications; Antiphanes Fr. 206 (*Poetae Comici Graeci*) makes clear the association with medicine but is no more specific: κατεσκευασμένος λαμπρότατον ἰατροῦ

Cupping Vessels

We may begin with a basic Hippocratic instrument, one frequently attested in the texts of the *Corpus* and the sole type of which we have indisputable pre-Roman survivals: the cupping vessel or *sikua* (σικύα).⁹ Altogether nine specimens survive, six from Ialysos, Rhodes, and one each from Corinth, Thebes, and Tanagra respectively, the last three all housed in the National Museum, Athens (Figg. 4–6).¹⁰ All were extracted from graves.¹¹ The pre-Roman models feature a less angular profile at the shoulder in contrast to the sharper accentuation of their Imperial counterparts.¹² There are also three cups with similar features shown suspended in the background on a relief now in the Antikenmuseum, Basel.¹³ This relief and the six specimens from the grave at

εὐχάλοις πάνυ λουτήρῳισιν, ἐξαλείπτροις, κυλίχνισιν, σικύασιν, ὑποθέτοισιν. For further treatment of *kulichnis*, see below: Tools of the Empire, Multipurpose Vessels.”

- 9 The name *sikua* was primarily applied to various gourds, the instrument deriving its name from their shape. For use of gourds in medicine, see *Epidemics* 7.62Smith, *Nature of Women* 61P and *Diseases of Women* 8.230.9–10L. Galen maintains that Hippocrates also used the term *sikuone* (σικυώνη) for cupping vessel (*Hippocratic Glossary* 19.137K). This is nowhere apparent in the surviving *Corpus*, save for *Diseases of Women* 8.222.35–37L where we encounter a *sikuone* of copper (σικυώνην—χαλκοῦ λευκοῦ). But the passage is corrupt at this point and should not be accepted as a dependable witness. Note the attempts to make sense of the passage in F.Z. Ermerins’ edition (Utrecht, 1859–64, vol. 2 pp. 668–9).
- 10 A specimen from a grave at Pydna, if as early as the reign of Alexander (356–323 BCE), would make ten. I only know of it from the cursory notice and photo in Dasen (2011) 14–15. Like the Tanagra specimen it is more angular in profile. Two of the Ialysos cups were lost in World War II; so Berger (1970) 175. The Tanagra specimen once sported a chain (now lost), apparently for suspension and removal. This can be seen in older photos; e.g. Milne (1907) Pl. XXXVIII. A cup with a chain is also inventoried among the dedications of the Athenian Asklepieion in the early fourth century BCE (cf. *IG* II² 47, lines 8–9: σικύα μ[εγ]ά[λη] ἀλύσει δεδεμένη).
- 11 For Ialysos see Berger (1970) 66; for Thebes, Tanagra and Corinth see Lambros (1895) 19–20.
- 12 Künzl (1983a) 21. The same profile is reflected on coins and other monuments of the period: see Berger (1970) 19–23; Jackson (1993) Pl. 1.
- 13 Berger (1970) 19–23. Traditionally a red figure vessel (the Aryballos Peytel, ca. 460 BCE), likely also from a grave, has been accepted as depicting a bleeding scene, similarly featuring three cupping vessels suspended in the background; hence the painter has come to be known as the Clinic Painter (see Boardman [1975] fig. 377). For a different interpretation see Krug (2012).

Ialysos are dated ca. 500 B.C., anchoring the earliest chronology of the pre-Roman type.¹⁴

Along with the applications of the cupping vessel, the *Corpus* makes it clear that size and contour varied to regulate a cup's drawing power.¹⁵ (For a fuller treatment of these features and the theory that lay behind cupping, see the section on Cupping Vessels under Tools of the Empire.)

The following passages attest the application of one or more cups and the situations in which they were used:

Ulcers 27P: The physician is enjoined to be sure a wound is fully drained of blood/fluid when cupping. If applying a cup to the knee area, the physician should have the patient stand.

Sight 9P: Cupping and bleeding for ophthalmia and similar complaints are mentioned in passing.

Places in Man 12P and *Epidemics* 2.6.24Smith: Both recommend fastening a cup behind the opposite ear in cases of ear infection.

Crises 59P: Placing a cup to "whichever of the parts above are in pain" is advised for headache.

Affections 4P prescribes fixing two cups to the back of the head with concomitant bleeding after shaving the area in cases of swollen uvula (γαργαρέων).

Diseases 2.26 and 2.27P direct the physician to apply a cup to the first vertebra of the neck in treating acute sore throat, while *Diseases* 2.55P recommends placing it

14 The Tanagra specimen features a more accentuated profile than other specimens. This suggests that it may represent an intermediate stage on the way to Roman types and on that account may be later than they. I incline to date it between the 4th and 2nd centuries BCE. The new find from Pydna might also belong here.

15 For broad and tapering cups with extra drawing power see *Ancient Medicine* 1.22.17–20L:—αἱ σικύαι προσβαλλόμεναι ἐξ εὐρέος ἐς στενώτερον ἐστενωμέναι πρὸς τοῦτο τετεχνέεται, πρὸς τὸ ἔλκειν ἀπὸ τῆς σαρκὸς καὶ ἐπισπᾶσθαι. *Physician* 7P is useful in referring to cups that are not too heavy and have a narrow mouth, moderate belly, and lengthened apex, as well as to cups with a wider mouth. The former allow for a direct draw and the latter for a wider more inclusive draw. My examination of the cup from Thebes (Fig. 5) in May of 2002 revealed that it was appreciably heavier than the other specimens in the National Museum.

under the shoulder blade with incision of the veins in the arms in treating erysipelas of the lung.

Joints 4.48.21–23L and *Instruments of Reduction* 4.38.17L mention attempts by some physicians to reduce a depressed vertebra with a large cup, an operation highly disapproved of in both passages.

Places in Man 22P and *Epidemics* 4.20(f)Smith attest cupping at an unspecified location to relieve sciatica, while cupping with bleeding of the ham for sciatica arising from blood is noted in *Internal Affections* 51P. To these procedures we may add cupping to relieve pain in hip and groin (*Epidemics* 5.8Smith).

Internal Affections 21P advises application of a cup to the loins and slitting the widest vessels of the scrotum in disease arising from phlegm. The same treatise recommends cupping for swelling of joints consequent on typhus (41P).

Other passages of interest have to do with female conditions.

Aphorisms 4.5.50L and *Epidemics* 2.6.16Smith: Both recommend a large cup applied to one or both breasts to control menstruation. *Diseases of Women* 8.110.38–41L is, in part, incomprehensible and, therefore, probably corrupt. However it seems to represent a more detailed treatment of the same or some similar condition. Here cups are applied below the breasts, sometimes on the left, sometimes on the right, without bleeding, in treating “white, reddish or red flux.”

Nature of Women 5P, repeated by *Diseases of Women* 8.144.20 and 8.248.16L advise (in the wake of other remedies) that the largest possible cup be fastened to the hip to remedy prolapse of the uterus.

Diseases of Women 8.71.22 and 8.233.22L treat uterine moles with a cup to the flanks, along with copious bleeding.

Cutting and Puncturing Instruments

In situations requiring an instrument for incising or lancing, the preferred Hippocratic designation is simply the general term for ‘knife’: *machaira*

(μάχαιρα) or *machairis* (μαχαίρις), but generally the diminutive μαχαίριον.¹⁶ As there are no material survivals,¹⁷ we have only nomenclature to go on. That employed would lead to the conclusion that the 'scalpel' or 'phlebotome' in the Hippocratic instrumentarium amounted to no more than a suitable everyday knife of the type employed in household or shop, were it not for the fact that an inscription of the early 4th century BCE refers specifically to "physicians knives."¹⁸ So it may be that a surgeon's knife assumed a particular form and/or size, at least at that time. In contrast, the surgical literature of the Roman Empire features the technical term *smile* (σμίλη), and numerous examples survive in surgical kits of the period. We do once find *smile* in the *Hippocratic Corpus* (*Diseases* 2.36P) but, like *machaira/is*, *smile* was merely a general term in Hippocrates' time; so too were the terms *sideros* (σίδηρος) and its diminutive σιδήριον ('iron', 'instrument/blade of iron') which also occasionally appear (see *LSJ* ss.vv.).¹⁹ In fact, we find many instances in which the Hippocratic physician/surgeon makes use of items ordinarily intended for other purposes, as opposed to those specifically designed for medical and pharmaceutical applications;²⁰ on still other occasions he may himself make, or get made, gear for a particular purpose. This tendency to improvise at the time of an operation, as opposed to having instruments permanently available, may have further implications. These will be discussed at the conclusion of this chapter.

Although the Hippocratic 'scalpel' is designated mainly by only one name, it is clear that different blades were required for the various surgeries performed. This is in fact explicitly stated in *Physician* 6P as well as indicated by the adjectives applied to scalpels and their blades in the *Corpus*. A blade may be pointed or broad (τοῖς δὲ μαχαίρισις ὁξέσι τε χρῆσθαι καὶ πλατέσιν . . .), sharp or extremely sharp (ὁξύ, ὁξυτάτῳ, ὁξυβελεί), extremely sharp and fine (ὁξυτάτοις καὶ λεπτοτάτοις), curved and not too narrow at the tip (καμπύλοις ἐξ ἄκρου μὴ λίγην στενοῖς), more curved than straight (καμπύλωτερον ἢ ἰθύτερον), and shaped like a woman's breast (στηθοειδέϊ).²¹ The point of the blade is called τὸ ἄκρον.

The following are relevant passages.

16 For *machairion* in the sense of 'scalpel' in lay texts see Aristotle, *Metaph.* 1061a4 and *Gen. Animals* 789b13.

17 Unless provided by the Pydna grave; see Dasen (2011) 14–15.

18 See *IG II²* 47 (early 4th cent. BCE), line 17: μαχαίρια καὶ καρκίνος ἱατρικά.

19 See the reference to σίδηρος in the famous Hippocratic aphorism: 'Οκόσα φάρμακα οὐκ ἴηται, σίδηρος ἴηται· ὅσα σίδηρος οὐκ ἴηται, πῦρ ἴηται· ὅσα δὲ πῦρ οὐκ ἴηται, ταῦτα χρὴ νομίζειν ἀνίατα (*Aphorisms* 4.7.87L). See also *Diseases of Women* 8.249.3L and *Decorum* 9.8.6L.

20 Lopez-Salva (1999), esp. 311–12, is particularly good on this point.

21 Galen readily identified the latter type as the common bellied scalpel of his own time. See *Hippocratic Glossary* 19.120K: μαχαίριδι στηθοειδέϊ· τῷ σμίλῳ ἱατρικῶ γαστρῶδει. A relief of the 4th cent. BCE now in the National Museum, Athens shows Amphiareus operating

Diseases 2.30P attests excision of tubercles “with a knife” (μαχαίρῳ) in cases of tonsillitis.

Diseases 2.47P, the famous passage on empyema, directs the physician to access the pus pocket by cutting first through the skin between the ribs with a breast shaped knife (σθηθοειδέϊ μαχαίριδι) and then to puncture the pocket with a sharp one (ὀξύβελέϊ) after wrapping its blade with a bit of cloth about the length of a thumb nail below the point (τὸ ἄκρον τῆς μαχαίριδος).²²

Other passages detailing puncturing and incising include:

Affections 4P, where swollen uvula is lanced μαχαίρῳ.

Places in Man 25P and *Internal Affections* 22P where dropsy is relieved μαχαίρῳ and ὀξέῃ τῇ μαχαίρῃ respectively.

Diseases 2.36P where nasal polyp is accessed by splitting the nose “with a knife” (σμῖλῃ).

Passages attesting bleeding are:

Physician 7P, where curved knives not too narrow at the point (μαχαίρις δὲ τοῖς καμπύλοις ἐξ ἄκρου μὴ λίην στενοῖς) are recommended as a general rule.

Ulcers 24P, where swellings of the feet are to be incised with blades/knives “as sharp and fine as possible” (ὥς ὀξύτάτοισι σιδηροῖσι καὶ λεπτοτάτοισι).

Shifting to gynecological treatises, several passages describe opening the head or torso of and dismembering a fetus. *Diseases of Women* 8.70.4L requires that the operation be performed μαχαίρῳ (cf. *Excision of the Embryo* 8.1.11L) and, more specifically, at 8.70.25L that the knife be more curved than straight (τὸ μαχαίριον—καμπυλώτερον ἔστω ἢ ἰθύτερον).

with what may be the breast shaped type; see Zervos (1932) 31; Herzog (1931) plate to left of title page.

22 Evacuation by incision of a pus pocket at the hip is contemplated but not executed in *Epidemics* 5.7 Smith.

There are in addition numerous references to incision or lancing without mention of the knife employed. These have mainly to do with blood letting and need not be specified here. One remarkable exception is the sole Hippocratic testimonium to the operation for bladder stone in *Oath* (4.17–18L).²³ Unfortunately, no further details are provided.

Only twice do we find mention of special purpose knives. In treating acute sore throat (*Diseases* 2.28P) the practitioner is instructed to attach a sharp blade to a ring and strike the epiglottis (σιδήριον ὅξυ προσδησάμενος πρὸς δάκτυλον τύψαι); and, for purposes of dismembering a fetus a ‘claw’ (ὄνυξ) mounted on the thumb is employed, this apparently also attached to a ring (*Superfetation* 7P).²⁴ The ring knife applied in the first case is clearly created on the spur of the moment, and nothing in the language of *Superfetation* compels us to believe that the second was a regularly used tool either.

There are three passages in the *Hippocratic Corpus* recording the use of needles for surgical purposes. The first occurs in *Internal Affections* 41P in connection with swelling of the knees in typhus. In this situation the practitioner is told to pierce the knees with the point of a triangular needle or *akis* (κέντρον ἀκίδος τριγώνου). This *akis* might be a specialty item designed for surgery. In the other two cases it appears that ordinary household needles are employed for surgical or parasurgical purposes. In the *Appendix to Regimen in Acute Diseases* 61–62P the text is sometimes difficult to interpret, but it is clear that the author recommends using a needle or *belone* (βελόνη) to encompass hemorrhoids and the papillary growths of trichiasis with stitches for purposes of removal by strangulation. Finally, in *Superfetation* 8P, where forceable removal of secundines is the topic, a *raphion* (ῥαφίον)²⁵ or common needle for stitching is used to puncture a water filled sack on which a newborn has been placed. Since the umbilical cord of the baby has not yet been cut, the afterbirth is gently withdrawn as the water drains off and the child slowly descends on the sack.

Cauteries

Throughout the *Hippocratic Corpus* there are many conditions for which the practitioner is urged “to burn” (καίειν); that is, to apply a cautery, even though

23 There are references to bladder stone here and there in the *Corpus* (e.g. *Nature of Man* 6.12.22–25L; *Airs, Waters, Places* 2.9L); but, for any description of a surgical procedure to remove them, we have to wait until the first century CE and Celsus 7.26.2 ff.

24 ἔχειν δὲ χρὴ πρὸς τὰ τοιαῦτα καὶ ὄνυχον ἐπὶ τῷ δακτύλῳ τῷ μεγάλῳ.

25 Milne prefers an alternate reading: γραφίω: “with a stylus.”

this intervention was recognized as the most radical of all.²⁶ Later the names derived from *καλῆν*, *kauter* (*καυτήρ*), its diminutive *kauterion* (*καυτήριον*) and, less frequently *kauster/kausterion* (*καυστήρ/καυστήριον*), were commonly applied to this instrument by Imperial authorities. However, the preferred term throughout the *Corpus* is *siderion* (*σιδήριον*) or 'little instrument of iron', a name which is used of other surgical tools as well, such as elevators and, as we have seen, of cutting instruments. We once encounter *kausterion* (along with *siderion*) in *Sight* 3P. There may also be an instance of *kauster*, this in *Hemorrhoids* 6.6.1L; however, the reading is disputed and *kauter* may in fact have been written originally.²⁷ Whichever reading is correct, it does not designate a cautery but a reed-like tube through which the actual cautery is run. Finally Inventory IV of the dedications to Asclepius in Athens record a *κοῖλον ἐγκαυστήριον* ('hollow inburner') which is taken as a cauterizing tool.²⁸

As with knives we again encounter various types of cautery. These are distinguished by modifying adjectives. Thus cauterizing irons are said to be fine (*λεπτῶ*), thick (*παχέσι*), not thick nor excessively rounded but long (*μὴ παχέσι, μὴδὲ λίην φαλακροῖσιν, ἀλλὰ προμήκεσι*), wedge shaped (*σφηνίσκους*), and a span long, thick as a probe, and terminating in the form of an obol (*σπιθαμιαία τὸ μέγεθος, πάχος δὲ ὡσεὶ μήλης παχείης· ἐξ ἄκρου δὲ κατακάμψαι· καὶ ἐπὶ τῷ ἄκρῳ πλατὺ ἔστω ὡς ἐπὶ ὀβολοῦ μικροῦ*). As the name *siderion* implies, most of the time the Hippocratic cautery was composed of iron, iron being a most effective conductor of heat, especially in cases where the instrument was required to be red-hot (*διαφανές*). However, there are copper alloy survivals from the Roman period, and there is no need to suppose that this was not sometimes the case with Hippocratic models.²⁹ Nor can we preclude the use of other instruments like knives and probes as cauterizing tools.

As we consider the applications of the cautery in those passages where the instrument is actually mentioned (as opposed to general references to burning), particularly noteworthy are the frequent injunctions in the middle voice that the surgeon should 'make/prepare for himself' or 'get made/prepared' the appropriate type of cautery; or, as they are often used in quantity, the appropriate cauteries necessary. This again supports the contention that the Hippocratic often made himself, or had prepared by, e.g., a smith, what he required as it was

26 So the famous Aphorism 4.7.87.1–3L.

27 So Potter's text in vol. VIII of the Loeb edition, p. 386.

28 IG II² 1534A line 84 (274/3 BCE) as presented in Aleshire (1989) 182. See further pp. 44 & 235 of the same work.

29 One thinks here especially of the two specimens of copper alloy from Pompeii in the Naples Museum; see Bliquez, Jackson (1994) 134(103–104) = Fig. 2, middle row, center.

needed. We should also note that in several cases natural substances were used rather than cauteries of metal. These included, for cure of liver disease, shafts of boxwood shaped like spindles and tree fungi (μύκησι).³⁰ Natural substances recur in texts of the Empire (see Tools of the Empire: Natural Substances Used in Cauterization).

As to actual therapy, the treatise *Hemorrhoids* several times recommends preparation of specified cauteries for burning piles, including the obol shaped types (2P)³¹ and the type passed through the reed-like tube (6P).³² Yet a third method is desiccation by passing cauteries over piles without actually making contact (5P). A protective tube or *surinx* (σύριγγξ) appears again in *Diseases* 6–7.2.34L where the subject is treatment of nasal polyp.³³ Wedge shaped models are to be fashioned for burning the temporal vessels in treatment of disease of the head (*Diseases* 2.12P).³⁴ The treatise *SightP* recommends thick types for burning to the spine and then transferring heat through oiled sponges (3).³⁵ The same tract cauterizes with moderately hot models (μὴ διαφανέσι) after trimming abnormally thick eyelids (4). Turning to *Internal Affections*, the application of unspecified cauteries, in addition to fungi, are recommended for treating kidney disease (18P), dropsies arising from the liver and spleen (24 & 25P), and sciatica (51P). Finally, there is the well known (and unfortunate) injunction in *Joints* 4.11.14–70L to toughen up shoulders prone to dislocation by raising the skin near the armpit and passing through it “irons . . . not thick nor too rounded but long.”³⁶ Some sort of probe called *hupaleiptron* (see below) is then thrust through the two openings created and a fine cautery pushed down from above until it intersects the *hupaleiptron*. The idea is that the resulting scarification will firm up the area and keep the humerus from slipping out of joint.

30 *Int. Affect.* 28P: καῦσαι χρή, ὁκόταν μέγιστον τὸ ἦπαρ γένηται καὶ ἐξεστήκη μάλιστα, πυξίνοισιν ἀτράκτοις, βάπτων ἐς ἔλαιον ζέον, προστιθέναι δὲ ἕως ἂν σοι δοκῇ καλῶς ἔχειν καὶ κέκαυσθαι εἶδ, ἢ μύκησιν ὁκτῶ ἐσχάρας καῦσαι.

31 παρασκευάσασθαι δὲ κελεύω ἐπτά ἢ ὁκτῶ σιδήρια, σπιθαμιαῖα τὸ μέγεθος, πάχος δὲ ὥσει μῆλης παχεῖης· ἐξ ἄκρου δὲ κατακάμψαι· καὶ ἐπὶ τῷ ἄκρῳ πλατὺ ἔστω ὡς ἐπὶ ὀβολοῦ μικροῦ.

32 —καυστήρα ποιήσασθαι, οἷον καλαμίσκον φραγμίτην· σιδήριον δὲ ἐναρμόσαι καλῶς ἀρμόζον· ἔπειτα τὸν αὐλίσκον ἐνθεῖς ἐς τὴν ἔδρην, διαφαίνον τὸ σιδήριον καθιέναι, —.

33 ἐνθέντα χρή σύριγγα (σύριγγια Potter) καῦσαι σιδηρίοισιν ἢ τρισὶν ἢ τέσσαρσιν·

34 τοῖσι δὲ σιδηρίοισι σφηνίσκους ποιησάμενος, διακαίειν πλαγίας τὰς φλέβας.

35 καίειν παχέσι σιδηρίοισι . . .

36 σιδηρίοισι δὲ χρή ταῦτα καίειν, μὴ παχέσι, μὴδὲ λίγην φαλακροῖσιν ἀλλὰ προμήκεσι . . . 18–19.

Probes

Mention of the *hupaleiptron* (ὑπάλειπτρον) brings us to the category of probing instruments.

As in all Greco-Roman surgical texts, the predominant term in the Hippocratic *Corpus* is *mele* (μήλη). Though it is never made explicit, one assumes that ordinarily the *mele* was composed of metal and that the metal was usually copper alloy.³⁷ We have seen in *Liquids* 1 that copper alloy was a primary material for Hippocratic instruments. This continued to be the basic material used in Roman times, as is clear from the many surviving instrumentaria of the period, including the various probe types found in them. However, on the few occasions in the *Corpus* when we do have a specific metal assigned to a probe, it is either tin or lead (see below). Of course other materials, like the shafts of wood and the plumes of feathers used by the physicians of the Empire, could certainly have been deployed as probes in Hippocrates' time. And, in fact, one several times finds a feather being used to support a swab (*Diseases of Women* 8.126.6–12 & 244.6–7L), while once a garlic stalk (φύσιγγξ) is utilized for probing a fistula (*Fistulas* 3P). On occasion we even hear of a finger employed for purposes of probing and dilating the cervix (*Nature of Women* 35, 37, and 39P; *Diseases of Women* 8.60.24–26L).

Very little information is given as to size and shape. In the main the Hippocratic *mele* seems to have been any serviceable shaft of metal. As we are told in *Diseases of Women* that the tip of a clyster pipe should be “smooth like that of a *mele*”,³⁸ we have to conclude that usually at least one terminus must have been rounded. As noted above, in *Hemorrhoids* 2P the practitioner is directed to secure cauteries as thick as a thick *mele* (μήλης παχείης). In other cases he is advised to use a notched *mele*, or (several times) one perforated with an eye, like a needle; and once he is told to make a series graduated in size and hollow at one end (μήλας—ὀπισθεν κοίλας), so as to admit a handle. These types will be discussed momentarily.

Though some Hippocratic probes must have mounted a spatula or a spoon, this is not easy to prove. Descriptive terms like *spathomele* (σπαθομήλη), so familiar later, do not occur in the *Corpus* as transmitted. Galen does declare in his *Hippocratic Glossary* that *spathomele* (‘spatula probe’) was meant by ‘flat *mele*’ and by ‘rotound *mele*’, terms contained in texts of the *Corpus* that we

37 We find the *mele* among the dedications in the Athenian Asclepieum in 244/3 BCE; see IG 11² 1534B and 1535, lines 155 & 161 as presented in Aleshire (1989) 163–164. Probes left in a sanctuary must have been of metal if they were valued enough to be dedications.

38 τὸ μὲν ἄκρον τοῦ κλυστήρος λεῖον ἔστω, οἷον περ μήλης . . . *Diseases of Women* 8.222.14L.

no longer have.³⁹ However, one suspects that Galen is only guessing what lay behind these names when he does an about face elsewhere and asserts that the phrase ‘the flat of a *mele*’, also mentioned in a text not transmitted, must in this instance refer to a type of ‘ophthalmic spoon.’⁴⁰

Common functions of the *mele* included simple probing and administration of medicaments.⁴¹ It was also employed as a director or block; for example, in opening a fistula by providing support and direction for a knife after being inserted into a fistulous canal (*Fistulas* 5P). Similarly, a *mele* might also serve as backing for a knife in enlarging an ulcerous lesion (*Ulcers* 10P). We find in addition one reference to its use in pressuring vessels for regulating blood letting (*Ulcers* 24P).

A milder treatment for fistula was called by later authorities apolinosis.⁴² In this process strands of linen twisted into a cord around a horse hair were drawn through the fistulous canal by an eyed, tin (therefore flexible) *mele* gotten up for the purpose (ποιησάμενος μήλην κασσιτερίνην ἐπ’ ἄχρου τετρημένην). The index finger was then inserted into the anus to bend aside and draw out the *mele*, followed by the end of the cord attached to its eye. The ends of the cord were then pulled together and knotted tightly, so that they put pressure on the terminal openings of the fistula. As the cord gently cut its way into the fistula on both sides, it was tightened, fresh cord being fastened to the more durable horse hair and introduced as necessary until the canal had been entirely opened and made subject to medication (*Fistulas* 4P).

Otherwise, we frequently encounter the *mele* in dealing with female conditions. In particular, we hear a great deal about application of the *mele* for dilation of the cervix. What seems to be involved in each case is simply a plain rod of appropriate length and thickness.

The following Hippocratic gynecological texts employ the *mele* in probing and dilating operations, usually with the object of administering medicaments, for: indurated womb (*Nature of Women* 37P; *Diseases of Women* 8.156.10–13L); hydrops or watery discharge of the womb (*Diseases of Women* 8.60.22–27L and *Nature of Women* 35P, where a tin model is to be made up for the purpose); closure of the womb (*Nature of Women* 39P); and induration and closure of same

39 19.122K: μήλη πλατεῖη· τῇ σπαθομήλῃ; 19.141K· στρογγύλον μήλην· τὴν σπαθομήλῃν.

40 19.122K: μήλης τῷ πλατέει· τῷ κυαθίσκῳ τῆς ὀφθαλμικῆς μήλης.

41 See *Epidemics* 7.8Smith (probe as a measuring device); *Diseases* 2.33P (inserting linen pledget in nose after removal of polyp); *On Head Wounds* 10.2Hanson (to determine nature of skull lesion); *On Head Wounds* 21.4Hanson (testing depth of track of a trephine); and *Coan Prenotions* 404P (testing the color of pus).

42 See, e.g., Paul of Aegina 6.78.3.

(*Diseases of Women* 8.228.6–10L). Likewise we find the *mele* useful for: application of “some of the black drug for the head” in cases of hysteria (*Diseases of Women* 8.126.10–12L); application of beaver testicle and white wine positioned on a wool swab to encourage pregnancy (*Diseases of Women* 8.221.34–36L); medicating a womb inclined to miscarriage (*Diseases of Women* 8.238.11–16L; *Superfetation* 27P); and opening a cervix blocked by poros, a stone-like callous (*Diseases of Women* 8.244.6–14L). In the latter case, the ‘*mele*’ is no more than a bunch of fine soft feathers dipped in rose oil.

In some instances the cervix was dilated gradually for medicating by introducing a series of tin or lead *melai*, each succeeding one thicker than the former and hollow at one end so as to admit a wooden handle before being deployed. We encounter this operation twice in more or less the same language in recommendations for promoting conception (*Diseases of Women* 8.217.23–29L; *Superfetation* 29P). We hear again of the same procedure at *Diseases of Women* 8.221.11–16L where, however, the number of probes to be inserted is given as precisely five and the probes themselves are not called *melai* but “drawn pieces of lead 3.5 inches long.”⁴³ A further variation occurs at *Diseases of Women* 8.157.8–12L. Here, when a sclerotic cervix has been softened by soothing medications, a series of three graduated raw linen plugs or *mota*, themselves medicated, are inserted for dilation, the last measuring the length of the small finger and ca. 3.5 inches wide.⁴⁴ Wooden dilators too were employed. In a lengthy passage (*Diseases of Women* 8.133.84–135L) prescribing measures for redirecting a displaced uterus to its proper position and promoting menstruation, the treatment requires, in part, insertion of six graduated probes into the previously fumigated cervix. This time the probes are called *prostheta* and *daidia* (προσθετά; δαιδία). These are round, pointed at each terminus, and measure ca. 4.2 inches in length. The largest of the set is to be as thick as the index finger and smaller at one terminus than at the other. As these dilator/probes were of pinewood, there is concern that they should not be marred by splinters and should be lubricated with fat to facilitate their insertion. It is clear from the text that these *prostheta/daidia* were not permanent items in the toolbox but were produced on site for the purpose at hand. The same is surely true for the single probe/dilator called *molubdion* (μολύβδιον) or ‘little piece of lead’ inserted before and after fumigation at *Diseases of Women* 8.11.49–52L in preparation for coitus.

43 μολιβδαίοισιν ἑλληλασμένοις ὀκτω δακτύλοισι πέντε—.

44 μοτοῦν ὠμολίνῳ καθετήρῃ, ᾧ τοὺς ἐμπύους, μοτοῖσι τρισί· τῷ μὲν πρώτῳ λεπτῷ, τῷ δὲ δευτέρῳ ὀλίγον παχυτέρῳ· ὁ δὲ παχύτατος ἔστω τῷ μεγέθει ὅσον ὁ σμικρὸς δάκτυλος, μήκος δὲ πέντε δακτύλων.

Also to be associated with dilation is the *mele diastomotris* (μήλη διαστομωτρίς). The name surfaces only in Galen's *Hippocratic Glossary* (19.92 and 122K), meaning again that it occurred in a Hippocratic treatise now lost to us but not to him. Galen equates *mele diastomotris* with *mele diastellousa* (μήλη διαστέλλουσα) and *diastoleus* (διαστολεύς), terms used by him and other Greek authors of the Empire to designate a uterine speculum. Perhaps for this reason Milne took the *mele diastomotris* to be a special type of uterine dilator. But, as no such dilator is recognizable among surviving instruments and as both Hippocratics and later authorities⁴⁵ refer to penetration of the cervix with an ordinary probe, that is, a *mele* or its equivalent, the term *mele diastomotris* may be no more than a fancy name coined by a Hippocratic for a μήλη employed in this manner.⁴⁶

This brings us to *rhabdos* (ῥάβδος) and *atraktos* (ἄτρακτος), names designating rod-like objects that are several times substituted for *mele*. These were hardly medical terms, the former being applied to all sorts of rod-like objects from walking sticks to fishing poles, the latter usually designating a spindle or the shaft of an arrow. Only simple probes must be meant.

In discussing the Hippocratic use of these terms we may cite first two well-known passages in *Diseases*, the subject of which is nasal polyp. The polyp can be torn away and drawn into the mouth, either by drawing a ball of sponge attached to a linen cord through the affected nasal passage (2.33P),⁴⁷ or by looping a noose of gut attached to a linen cord over the polyp and pulling it off that way (2.35P). In the latter case the noose is set around the polyp by means of a notched probe (τῇ μήλῃ τῇ ἐντετμημένῃ). As with the eyed tin *mele* mentioned above in connection with fistula, the cords attached to the ball and noose are both introduced and brought to the back of the throat with an eyed *rhabdos* of tin (ῥάβδον—κασσιτερίνην λεπτήν ἐκ τοῦ ἐτέρου κύαρ ἔχουσαν) through which they have been threaded. To facilitate drawing the cords the operator is to pass them over a forked/cloven object or *khele* (χηλή) used as a fulcrum.⁴⁸ As the

45 For example, Galen and others test for pregnancy by attempting to insert a probe into the mouth of the cervix. See *Natural Faculties* (2.150K), *Dissection of Uterus* (2.897K) and Aëtius 16.1.57–60. These are but a few instances.

46 Milne (1907) 82, citing Védrenes, considers a hollow tube shaped like a serpent that was recovered in Pompeii; but this curious item does not appear to have been found in a surgical context. See Bliquez, Jackson (1994) 3(O).

47 Explanations of this procedure vary and the text may be corrupt; see Potter's note ad loc.

48 In treating χηλή in his *Hippocratic Glossary* (19.155 & 19.93K) Galen offers the definition μήλη δίκρους, which does not get us any closer to envisaging exactly what the Hippocratic author has in mind. A small forked instrument has been recovered in a Roman surgical grave at Savaria/Szombathely (Künzl [1983a] 92.117[4]); and objects of copper alloy survive that might have served in some capacity as eyed probes (Künzl [1983a] 51.19[18 & 21]).

term *khele* was used to designate the notch of an arrow, a wooden shaft featuring a shallow notch with dulled edges comes readily to mind.⁴⁹

Likewise in dealing with female conditions we once find the diminutive of *rhabdos* used instead of *mele*, in this case a wool wrapped ῥαβδίον to administer black hellebore to expel a dead fetus (*Diseases of Women* 8.91.18L). Also mounting a woolen swab to clean sputum from throat in cases of acute sore throat is a *rhabdos* of flexible myrtle twig mentioned in *Diseases* 2.26P.

Sight 4P provides the one testimonium to *atraktos*. There we find a bit of wool wound around an *atraktos* for curetting the eyelid.

We may now return to *hupaleiptron*, the term with which we began this section. We find deployment of the instrument in gynecological operations such as dilation of a tightly constricted cervix (*Diseases of Women* 8.163.8–9L) and probing an infected womb (*Superfetation* 28P).⁵⁰ A thick model is recommended for resetting a broken nose (*Joints* 4.37.5–7L) and a fine one, as noted above, to limit the amount of burning by cauteries in the famous passage on treatment of dislocated shoulder in *Joints* (4.11.25–31L).

Except for the references to ‘thickness’ or ‘thinness’ we are given no details as to the appearance of the *hupaleiptron*. This would seem to explain the ambiguity about it later. Galen, for example, clearly took his cue, not from anything he found in Hippocrates, but from the kindred verb ὑπαλείφω or ‘annoint.’ Thus, he interprets the *hupaleiptron* as “anything that can annoint, such as probes (*melai*), spatula probes and *dipyrenes*, all of these having rounded heads at the end”; or again as, “a little plate for annointing the eyes.”⁵¹ Erotian complicates the picture while expanding it, allowing for the *melotis* (a type of spoon probe so named in Romans sources) as well as the *mele* (*Hippocratic Glossary* 97.2–3). Clearly no one knew precisely what *hupaleiptron* meant and this opened the way to a range of possibilities. Whatever the Hippocratic physician regarded as an *hupaleiptron*, all we can say for certain is that its operations in the *Hippocratic Corpus* require no more than a plain rod of varying thickness. Note, for example, that in two passages treating closure of the womb in much the same language, *Diseases of Women* 8.163.8L easily substitutes an

49 As Milne (1907) 83 noted, only a blunt type of notch would be safe to use in this sort of procedure in the back of the throat.

50 Here he calls the instrument μήλην ὑπαλειπτρίδα. Is the probing preparatory to clystering (κλύσις, Littré) or cauterizing (καύσις, Potter)?

51 εἰ μὴ δυνατὸν, φησὶν [Hippocrates], εἴη ἐντιθέναι τῇ ῥινὶ τοὺς δακτύλους, ὑπαλείπτρῳ χρηστέον. ὀνομάζει δ' οὕτως, ὥς ἦδη πρόσθεν εἶπον ἅπαν ὅτι ἂν ὑπαλείψειεν, οἰαίπερ μίλαι τε καὶ σπαθομίλαι καὶ τὰ διαπύρινα κατὰ τὸ πέρας αὐτῶν ἔχοντα ταῦτα πάντα κεφαλὰς περιφερεῖς (*Comm. Hipp. Joints* 18a.478K); ὑπάλειπτρον· ἐλασμάτιον ᾧ ἂν τις ὑπαλείψαιτο τοὺς ὀφθαλμούς (*Hippocratic Glossary* 19.148K).

hupaleiptron for the ordinary *mele* employed in *Nature of Women* 39P. So, we should be cautious. When later authorities like Galen and Erotian equate the *hupaleiptron* with spoon probes, spatulas and instruments “having rounded heads at the end”—surely a reference to the olivary enlargements commonly found on Roman probe types but a feature never mentioned in the *Hippocratic Corpus*—they are probably simply guessing, and are basing their conjectures on the probes of their own time.⁵²

Finally, *mele ischure* (μήλη ισχυρή) or ‘strong/powerful *mele*’ is another term that we know only through the *Hippocratic Glossary* compiled by Galen (19.122K). It is briefly defined without further comment as a ‘wound probe’ or *traumatike mele* (τραυματική μήλη). If Galen connected the Hippocratic “strong *mele*” with wounds, he most likely found the name in the lost treatise *On Wounds and Missiles*.⁵³ For Galen and Byzantine authorities like Oribasius and Paul the wound probe was a spoon or scoop.⁵⁴ The same may have been true of the Hippocratic *mele ischure* but it is also possible that it took the form of some type of lever, such as those used by Hippocratics for reducing fractures. That brings us to instruments used for bone surgery.

Bone and Tooth Instruments

Among the more heavy duty items in the Hippocratic arsenal are the drills and levers/elevators likely inspired by, and certainly adapted from, the types employed by carpenters, smiths and stone masons.⁵⁵

The Hippocratic surgeon must have employed a plain-toothed saw or *prion* (πρίων) because, although he was leery of amputating limbs, he was willing to remove diseased or traumatized digits or a hand or foot.⁵⁶ However, all actual Hippocratic references to *prion* designate the crown drill employed for trephining the skull, also termed *prion kharaktos* (πρίων χαρακτός; *On Head Wounds* 21.4Hanson). In his *Hippocratic Glossary* Galen claims that the name *orthoprion* (ὀρθοπρίων) was also applied to the trephine by Hippocrates although, as so often, the term occurs in no surviving Hippocratic treatise.⁵⁷ Another Hippocratic term used for drill is *trupanon* (τρυπάνον), which covers

52 For this olivary enlargement or *puren* (πυρήν), see the section in *Tools of the Empire: Probes (Including Spatulas and Spoons)*, s.v.

53 For this treatise see Salazar (1998) and Witt (2009) 234–270.

54 For Oribasius and Paul see *Tools of the Empire, Probes, Mele Ischure*, etc.

55 *Fractures* 3.31bis.3–4L; so too Galen, *Comm. Hipp. Fractures* 18b.592K.

56 Cf. *Joints* 4.68.1–12L.

57 19.126K: ὀρθοπρίον· τῇ χοινικίδι.

both the crown drill and simple straight bits. The latter type is attested in *Internal Affections* 23P where the surgeon drills through rib to drain dropsy with a *trupanon pereterion* (τρυπάνω περητηρίω); this Galen correctly took to mean 'straight pointed'.⁵⁸

The Hippocratic descriptions of skull trephining occur in the famous treatise in *On Head Wounds* 21Hanson. The method here is to use crown drills to remove a circular piece of skull in consequence of a severe blow to the head, if an opening has not already been created by fracture. The idea was to avoid the problems consequent on suppuration at the base of the skull by providing a means of drainage.⁵⁹ The recommendation for use of a small trephine (σμικρῷ τρυπάνω) on young persons is clear evidence that the sizes of crown drills varied to meet changing situations. Although later authorities were luke-warm on skull trephining, the fact that the only surviving crown drills date to the time of the Roman Empire indicate that the operation continued to be practiced.⁶⁰ Though not mentioned in any Hippocratic surgical context, bows were clearly used to rotate the crown drills as it is recommended that the latter be cooled in water.⁶¹ Only a bow drill could produce that kind of friction and heat. A fifth century Attic red-figure vase by the Gallatin Ptr. showing a carpenter at work illustrates use of the bow drill quite well.⁶² The *Epidemics* are rich in accounts of trephination, including trephination of children.⁶³

We also find several references in *On Head Wounds* to the *xuster* (ξυστήρ), a scraping instrument (14.2, 4, 7 & 19.4Hanson). Milne maintained that this tool was a type of rasp, featuring a blade that was fixed at right angles to a shaft and that was drawn toward the operator.⁶⁴ But such an instrument type has never

58 *Hippocratic Glossary* 19.129K: περητηρίω· τρυπάνω τῷ εὐθεῖ καὶ ὀξεῖ· ἔστι γὰρ καὶ ἕτερον ἢ χοιναίς.

59 So thought the author of *Places in Man* 32P. Galen later subscribed to the same general view (*Meth. Healing* 10.452K = J-H 2.228–231).

60 For the Bingen survivals see *Tools of the Empire: Bone and Tooth Instruments*, s.v. Drills. Pseudo-Galen thought the process abandoned in his day (*Introduction or Physician* 14.783K), while Paul noted that it had been condemned by 'The Moderns', apparently meaning for him Byzantine authors as early as Oribasius, as is made clear in his Preface to Book 6.

61 *On Head Wounds* 21.3Hanson; so too Celsus 8.3.7. There is mention of the bow-drill in the treatise *Joints* but not in a surgical context 4.12.21L.

62 Boardman (1975) fig. 192.

63 The preferred terms are πρίω, πρίσις, ὄγω, and τρυπάω: see *Epidemics* 4.1 & 11; 5.16, 27 & 28; 6.7.4; and 7.35Smith.

64 Milne (1907) 121–122. Majno (1975) 169 apparently followed him in his illustration of the *xuster* of *On Head Wounds*. Its most recent editor, M. Hanson, also translates *xuster* as 'rasp.'

emerged from either Roman graves or settlement sites. I am therefore inclined to think that no more than a small file or even a sharp edged spoon or strigil is meant.⁶⁵ Be that as it may, the *xuster* is recommended for leveling contusions to the skull and for determining the existence and location of fractures. For, as noted, in the absence of fractures trephining was thought necessary.

In the treatise *Fractures* (31.bis 1–25L) the surgeon is urged to have prepared, or to prepare for himself (χρῆ ποιέεσθαι), levering devices to be used along with extension in reducing compound fracture of the bone. As cauteries and sometimes scalpels, these tools are simply called *sideria* (σιδήρια) or ‘iron instruments’, and they are said to be like those used by stonemasons. Later in the section the term *mochlos* (μοχλός), the word used to designate the levers used by masons, is substituted for *siderion*, and this becomes one of the names preferred by Roman authorities. These elevators, we are told, should be prepared in several sizes, each being broader at one end and narrower on the other (τὸ μὲν τι πλατύτερον, τὸ δὲ τι στενότερον), and they should be strong, so as not to bend. When operating, one should apply the upper side of the lever to the upper bone and the lower side to the lower bone. If the upper bone is pointed so as not to afford purchase for the lever, a notch should be cut in the bone for that purpose.

In *Joints* (4.67.6–8L) and *Instruments of Reduction* (4.33.14L) dislocated joints accompanied by wounds are reduced with a μοχλίσκος/*mochliskos* or ‘little lever.’ This should be round for internal dislocations and flat for external (τὰ μὲν ἔσω στρογγύλῳ, τὰ δὲ ἔξω πλατεῖ). That this *mochliskos* is the same device as the *siderion/mochlos* recommended in *Fractures* is clear because the author of *Joints* refers back to *Fractures* in recommending it (4.67.1–10L).

In his commentary on *Fractures*, Galen expands on the Hippocratic association of the *mochliskos* as the type of tool used by stonemasons. He notes that the surgical type is smaller and stresses the need to have a number of elevators available, each differing in length and in the width and thickness of its end (*Comm. Hipp. Fractures* 18b.592K).

Forceps, Retractors

One last instrument should be considered in connection with bone surgery, the *osteologon* (ὀστεολόγον). The name means literally ‘bone extractor.’ The *osteologon* must therefore have been an instrument resembling the sturdy

65 Files are sometimes found in Roman graves; see Künzl (1983a) 20 & 82(18) and now in the Domus ‘del chirurgo’ at Rimini; see Jackson (2003) 319, (2005) 5.1 (2) and (2009b) 85 & 89.

pliers-like forceps that goes by the name *ostagra* in Roman times. Ironically, the *osteologon* is not mentioned in the surviving Hippocratic tracts on bone surgery:⁶⁶ its sole occurrence comes in *Diseases of Women* 8.70.5L. There it serves to remove the skull fragments of an aborted embryo.⁶⁷ A similar function was later performed by the *ostagra*, of which there are archaeological survivals and which played a much wider role in surgery in the literature of the Roman Empire.⁶⁸

Two other relevant names surface in *Physician* 9P: *odontagra* and *staphulagra* (ὀδοντάγρα, σταφυλάγρα). We are told nothing about their applications, just that a neophyte physician needs to be conversant with their use. Their names, ending in *-agra*, indicate that both instruments were forceps (cf. *ostagra*) and were used on teeth (ὀδοντ-) and the uvula (σταφυλ-) respectively. Surviving Roman forceps types associated with these names are, like the *ostagra*, pliers-like; the *odontagra* likewise a heavy duty model, the *staphulagra* a lighter model with long handles and serrated spoon-like jaws.⁶⁹ Again, these tools had wider application than their names suggest, including weapons extraction, strangulation of hemorrhoids, etc. Hippocratic models were likely similar in shape and function. It may be, however, that their use emerged only late in the Hippocratic period. *Physician*, the sole pre-Roman witness to their existence, is thought to have been written in the mid to late fourth century.⁷⁰

A term not attested in the *Hippocratic Corpus* but which was apparently current ca. 400 BCE is *καρκίνος ιατρικός*. This name is found on the same inventory of dedications to Asclepius that includes cupping vessels and surgical knives (μαχαίρια ιατρικά).⁷¹

Oddly, the only reference to a less imposing forceps type is to the *labis* (λαβίς), probably no more than a common domestic tweezers. This occurs in *Diseases of Women* in the passage on treating poros of the cervix (8.244.15L).

66 It is likely that Hippocratics used a pliers-like forceps to draw an embedded point. Such must have been mentioned in the lost Hippocratic treatise *On Wounds and Missles*. If so, it may have been called *osteologon* or one of the names occurring in Paul of Aegina's chapter (6.88) on weapons extraction. For these names see the following discussion. For *On Wounds and Missles* see Salazar (1998) and Witt (2009) 234–270 who explore the relationship among this treatise, Celsus 7.5 and Paul 6.88.

67 See also the third book of *Diseases of Women* (37Potter = 8.249.2Litttré), also transmitted under the title *Barrenness*. There we find the bald term *sideron* used: ὀστεολογίη χρῆσθαι . . . τὸ δέρμα καταλείποντα προβολὴν τῷ σιδήρῳ.

68 See Tools of the Empire: Forceps, Bone (Sequestrum) Forceps.

69 See Tools of the Empire: Forceps, sections on Tooth/Stump Forceps and Uvula Forceps.

70 See Potter's summary of the scholarship on this question in his introduction to *Physician* in volume VIII of the Loeb edition, p. 298.

71 See IG II² 47 (early 4th cent. BCE), lines 16–19.

When lodged in the cervix, one can attempt to pluck away the poros “with a very fine *labis*” (λαβίδι ὡς λεπτοτάτῃ). It would seem that, like the *odontagra* and *staphulagra* just discussed, ordinary forceps of the spring variety were not much employed by the Hippocratics, perhaps because other instruments like probes (used for example to pry up growths), or even fingers, could be substituted.⁷²

Apparently substitutes were also frequently employed for the blunt and sharp hooks commonly cited in the literature of the Empire as useful for retraction. These instruments are readily recognized as well in the archaeological record of the period, particularly in the case of the sharp variety. Neither the sharp model called *ankistron* (ἄγκιστρον) nor the blunt type called *tuphlankistron* (τυφλάγκιστρον) occurs in the present *Hippocratic Corpus*. One item arousing curiosity that does occur is the *ankuromele* (ἄγκυρομήλη) or ‘anchor probe’, a name suggesting a hooked instrument. Both Galen (19.69K) and Erotian (51.5) list the term in their *Hippocratic Glossaries*, defining it as the *ankistron* known to them. Once again, unfortunately, *ankuromele* is not a name found in the *Corpus* as we presently have it. Still, if Erotian and Galen equated the *ankuromele* and the *ankistron*, they may have had at least one text in front of them that involved raising tissue, a blood vessel or the like with a hooked retractor. However, the dearth of testimony to retractors in Hippocratic literature, in contrast to the common mention of such instruments later, makes it doubtful that sharp or blunt retractors were widely used in the fifth and fourth centuries BCE. Occasionally, even in the literature of the Empire we find a forceps or fingers substituted for the sharp hook (Philumenus, *Venomous Creatures* 2.6.8 = Pseudo-Dioscorides, *Venomous Creatures* [*Theriaca*] 2.32; Paul 6.8.3). The Hippocratics may have employed fingers as a matter of course.

Gynecological Tools

Mention of the *osteologon* and its use in abortion raises the category of instruments used for gynecological purposes. In addition to the probes mentioned above for medication and dilation we encounter several other items.

In extracting a dead and bloated embryo the author of *Diseases of Women* 8.70.1–7L recommends first beheading it with a knife (μαχαίρῃ) and then breaking up its head with a cranioclast, called in Greek *piestron* (πίεστρον), before plucking out the skull fragments with the *osteologon*. Galen in his *Hippocratic Glossary* twice defines *piestron* as *embruothlastes* (ἐμβρυοθλάστης) or ‘embryo crusher’, the name used for the *piestron* in his time (19.104 and 130K).

⁷² As with evulsion of tonsils at *Diseases* 2.30P. So too Celsus 7.12.2.

He also attributes to Hippocrates the name *thlastes* (θλάστης) for the *piestron*, although it does not occur in the present *Corpus*. Strangely, no surviving post-Hippocratic medical treatise attests use of the cranioclast or describes its physical appearance. This may be because it was not often deployed. Soranus, for example, simply crushes the head of the embryo by hand (*Gynaecology* 4.11.3 Ilberg = 4.5.82–83 BGM). If the head could generally be managed in this efficient and convenient way, that might explain why a special cranioclast was rarely used, hence seldom mentioned in the literature. In any case, the name *piestron* or ‘squeezing tool’ suggests a pliers-like apparatus, operating on the same principle as the *osteologon*. The ophthalmologist and collector Theodor Meyer-Steineg secured one element of such an instrument, claiming that it came from Ephesus. It is regarded as of Byzantine date.⁷³ The piece consists of a curving toothed jaw mounted on a handle (Fig. 76). It would have been complimented with a similar member linked with it by a pivot or screw. Although the Meyer-Steineg instrument is much later than Hippocratic times, it gives us a sense what the *piestron* might have looked like.

The same passage in *Diseases of Women* recommends the *helkuster* (ἐλκυστήρ) or ‘dragging/pulling tool’ for extracting the rest of the fetus. As the instrument has to be attached to the clavicle and then pulled on, sometimes with greater and sometimes with lesser force, there is little doubt that the Hippocratic *helkuster* was a hooked instrument; thus, Galen in his *Hippocratic Glossary* (19.97K) does not hesitate to equate the *helkuster* with the *embruoulkos* (ἐλκυστήρι: ἐμβρουλκῶ), the sturdy hook used for the purpose in his time. Several examples of the *embruoulkos* recovered in Pompeii surely resemble the Hippocratic tool (Fig. 74).⁷⁴

While the *embruothlastes* and *embruoulkos* of the Empire were surely manufactured for the purposes indicated by their names (‘embryo crusher’, ‘embryo extractor’), the same cannot be said of the *piestron* or the *helkuster*.⁷⁵

73 Meyer-Steineg (1912) 37 and Taf. VI, 1; Künzl, (1992) 202–243.

74 Bliquez, Jackson (1994) 129. Galen also entertains in the *Hippocratic Glossary* (19.107K) the possibility that another Hippocratic name for this kind of instrument was *ikhthue* (ἰχθύη) after its resemblance to the half or quarter moon pattern created by superimposed scales of a fish. This term he found in *Excision of the Fetus* 1P = 8.1.7L where an *ikhthue* is fastened around (περιδῆσαι) the fingers of the operator’s hand to avoid slippage during traction. Galen’s first choice for *ikhthue* is dried fish skin, and this meaning is preferred by the latest translator (Potter). Galen’s conjecture of a hook or hooklike knife fastened to the fingers may have been prompted by the ‘claw’ (ῥυξ) of *Superfetation* 7P, worn on the thumb. His language rather suggests that: δύναται δὲ καὶ τὸν σιδηροῦν ὄνυχον δηλοῦν, ὥπερ εἰς τὰς ἐμβρουλικίας καὶ ἐμβρουστομίας χρῶμεθα.

75 On this point see Mazzini (1996) 21–23.

It is quite possible that, like the *machairion*, these tools were generally used for non-medical purposes.

The same is also likely true of two other knives recorded for dismembering an impacted embryo. In one case a curved knife is thrust into the birth canal with the operator's finger covering its point so as to protect the uterus (*Diseases of Women* 8.70.23–28L). This seems no more than an ordinary domestic knife suited to the purpose. A second device in *Superfetation* 7P is called an *onux* (ὄνυξ) or 'claw.' It should be worn, we are told, on the middle finger after the hand has been covered with wax, so as to be more easily introduced into the womb. Tertullian may also mention the instrument, apparently calling it *anuloculter* in *De Anima* (25.4–6), a passage treating abortion of an impacted embryo as a necessary act of cruelty.⁷⁶ As he specifically mentions Hippocrates in the course of treating abortion and the instruments used, Tertullian likely has the *onux* of *Superfetation* in mind. There exists no surviving specimen from any period of Greco-Roman antiquity.⁷⁷

In *Nature of Women* 42P thrombi formed on the cervix are removed by winding a bit of skin or membrane around a *xustra* (ξύστρα) and then curetting the area.⁷⁸ The reference here may be to a small strigil, as the name *xustra* is applied to this instrument of hygiene.⁷⁹ However, grammarians like Pollux and Phrynichus indicate that *xustra* in the sense of 'strigil' is late, the common term for strigil in the time of Hippocrates being *stlengis* (στλεγγίς).⁸⁰ Therefore, the Hippocratic author may simply have some spoon-like scraper in mind, which he kept from unnecessarily irritating the surface of the cervix by covering it with membrane.

76 The mss. read *anulo cultro* or *cultro anulo*, prompting emendations by Rigaltius (*anulo-cultro*) and Gelenius (*anulo cultrato*). Milne ([1907] 31 & 157) accepts the latter and J.H. Waszink the former ([1947] 36). Either can be interpreted in the sense of 'ring knife.' Waszink believes that Tertullian is thinking of the *uncus* used to dismember an embryo in Celsus 7.29.7. It features a cutting edge: *in interiore... partem per totam aciem exacuitur*.

77 Cüppers (1983), 40 and Riha (1986) 83 illustrate blades mounted on a ring in the same plane which some might identify as Roman versions of the Hippocratic type. But in both instances the blade is not hooked in the form of a 'claw' and is impractically arranged in any case. To be effective, the blade would have to be positioned perpendicular to the ring.

78 καὶ περὶ ξύστραν περιελίξας κύστιος* δέρμα ἢ ὑμένα, διαξύειν τὸ στόμα τῶν μητρῶν. *Littre read γυπὸς δέρμα, or 'vulture hide.' This is a peculiar requirement; hence the preferred reading of more recent editors.

79 For examples of the fourth century strigil see Robinson (1941) 172–181 & Pl. xxxii–xxxvi; see also Davidson (1952) 180–181 & Pl. 81–82.

80 See *Phrynichi Eclogae nomenclum et verborum Atticorum*, p. 299 of Ch. A. Lobeck's edition (G. Olms: Hildesheim, 1965).

Tubes

Sometimes female conditions were treated with medicaments delivered via tubes, which leads us to that category of instruments. One of the most arresting is described in *Diseases of Women* 8.222.11–25L. In cases of ulcerated uterus preventing conception the physician is directed to inject a solution of mare's milk. The douche, which is contained in a sow's bladder, is injected through a tube called *kluster* (κλυστήρ).⁸¹ This is said to have a smooth solid tip of silver and, after an opening near the tip, a series of openings at intervals along its sides.⁸² The patient herself can put the tube in the proper position before the physician makes the injection.⁸³ As often, the physician is told “to make the tube for himself” or “to get it made” (ποιησάμενος). In other words it, like other tools and devices used by the Hippocratics, is not ready to hand. The *klyster* tube is attested again for uterine lesions at *Diseases of Women* 8.66.34L and at *Diseases of Women* 8.179.8L for ‘uterine wind’ (ἄνεμος). Though no such tube survives from the time of Hippocrates, several copper alloy models retrieved in Pompeii closely follow the Hippocratic directives (Fig. 56).

Purging with enemas and douches is a frequently prescribed remedy throughout the *Corpus*. The apparatus employed is seldom described in any detail, in contrast to the device just cited; but any Hippocratic *kluster* surely had to be constructed along the same general lines: that is, made up of a bladder attached to some sort of hollow tube. In one case (*Fistulas* 6P) even the shaft (*surinx*) of a feather is deemed suitable for irrigating a fistula (κλύζειν δὲ πτεροῦ σύριγγα προσδήσας πρὸς κύστιν). The term *surinx* appears again in *Internal Affections* 6P. There erysipelas in the lung is treated with an oral medicament instilled into the mouth “through a *surinx*” (διὰ σύριγγος). Very likely here too only a handy natural tube such as a reed is meant.

In general the female treatises are the richest source of references to tubes. These often function as part of a douching apparatus, as above, or as one element of a device for fumigation. Such tubes go by several names, including *aulos* (αὐλός), literally ‘pipe’ or ‘hollow straw’, its diminutive, *auliskos*

81 The same term is also used of the liquid injected, along with κλύσμα and κλυσμός.

82 τὸ μὲν ἄκρον τοῦ κλυστήρος λεῖον ἔστω, οἷον περ μήλης, ἀργύρεον· καὶ παρ’ αὐτὸ τετραπήσθω τοῦ κλυστήρος ἀπολείπον ὀλίγον τὸ τρήμα· εἶναι δὲ καὶ ἄλλας ἐκτρήσεις, διαλειπέτω δὲ ἴσον ἐκάστη ἔνθεν καὶ ἔνθεν ἐκ τοῦ πλαγίου τοῦ κλυστήρος, καὶ μὴ μεγάλας, ἀλλὰ στενάς· τοῦ δὲ κλυστήρος ἢ μὲν κορυφῇ στερεῇ ἔστω, τὸ δὲ ἄλλο πᾶν κοῖλον ἔστω ὡς αὐλίσκος· δῆσαι δὲ χρὴ κύστιν συδὸς θηλείης...

83 Cf. *Diseases of Women* 8.11.49–53 and 8.221.14–15L where the patient self-administers placement of leaden probes.

(αὐλίσκος), and *kalamos* (κάλαμος) or ‘reed.’⁸⁴ Thus, ileus of the uterus should be irrigated with warm olive oil delivered via a bladder attached to an *auliskos* (*Diseases of Women* 8.131.5–7L). For various conditions a fumigation apparatus of a clay jug or basket sealed with a plastered wicker lid pierced with a *kalamos* or an *aulos* is recommended. These include prolapse of the uterus toward the hip joint (*Diseases of Women* 8.133.39–62L), uterine pain (*Diseases of Women* 8.172.7L) and promotion of conception (*Diseases of Women* 8.11.45–50L; *Diseases of Women* 8.221.2 & 34L). In some cases the fumigation device is no more than a gourd trimmed at its base and apex, as at *Nature of Women* 61P, where the mouth of the gourd (τὸ ἄκρον τῆς σικύης) is inserted into the vagina in treatment of strangury, or at *Diseases of Women* 8.230.8–27L, where, in treating sclerotic cervix, the woman seats herself on a wicker chair in order to better engage the *aulos* of the gourd.⁸⁵ Returning to *Diseases of Women* 8.222, which treats of ulcerated womb and promotion of conception, we again find a gourd (σικυώνη/σικύη) employed as a fumigating device (8.222.35–37L).⁸⁶ In one case of displaced uterus, fumigation is preceded by inflation of the uterus with an *auliskos*-bladder combination (*Nature of Women* 14P). Finally inflation of the uterus with an *auliskos* and bladder (αὐλίσκον προσθήσας πρὸς κύστιν) is prescribed for hysterical suffocation in *Nature of Women* 14P.⁸⁷ Once more, the devices needed for these operations give the impression of being created at the moment of treatment.

Tube-like instruments designated by the terms *aulos* and *auliskos* are also recorded for conditions other than specifically female disorders. At *Diseases* 3.10P, for example, *auliskoi* are thrust down the throat in cases of severe sore throat with danger of suffocation. These, we are told, allow the patient to breathe, and also serve to convey fumigation into the nose.⁸⁸ At 2.47P of the same work an *aulos* is recommended as useful in allowing the patient to inhale a vapor created by dropping heated *ostraka* into a solution of water parsnip, wine and goat’s or cow’s milk in the well known passage on combating empyema.

84 The diminutive *kalamiskos* occurs in Aristophanes, *Ach.* 1034 as a container for ointment (perhaps just a segment of reed).

85 In addition to this passage, others (e.g. *Nature of Women* 32(17)P; 34(24)P; 109(7)P) also require that the patient be seated ἐπὶ δίφρου or “on a chair,” mainly for fumigation but once for drawing out the placenta (*Superfetation* 8P). If this is not actually the μαιωτικὸς δίφρος or midwife’s chair of the Empire, it is certainly a pioneering model. See Tools of the Empire: Gynecological and Obstetrical Instruments, Midwife’s Chair, and Hanson (1994).

86 The passage is untranslatable in part, and therefore corrupt. But it resembles *Diseases of Women* 8.230.8–27L closely enough to make clear the general line of treatment.

87 An approach rejected later by Soranus of Ephesus, *Gyn.* 3.29.2 Ilberg = 3.5.126–128, 149–152 BGM.

88 Caelius Aurelianus, condemns this Hippocratic procedure at *Acut. Diseases* 3.4.29.

An *aulos* even proves handy in the inward reduction of a thighbone displaced at its head. This method is described by the author of *Joints* 4.77.6–13L, though he prefers other procedures. The idea is to inflate with the *aulos* a bladder placed between the previously bound together thighs of the patient. And in *Hemorrhoids* 6P, as quoted above, the reed-like tube through which a cautery is passed in destroying piles is termed *auliskos* as well as *kauster* or *kauter*.

At *Diseases* 1.6P the catheter is referred to as an *auliskos*.⁸⁹ Little is said about the instrument other than that the mark of a physician is to know how to insert one into the bladder. Still, this reference arrests attention because catheterization of a male would require an S-shaped model to conform to the contours of the male urethra. Yet, Pseudo-Galen associates invention of the S-shaped catheter with Erasistratus of Iulis at a later date (*Introduction or Physician* 14.750 & 788K), and this testimonium has been generally accepted.⁹⁰ But if the author of *Diseases* 1 is right, Pseudo-Galen must be in error. If so, Erasistratus' contribution to the development of the catheter had to involve some other refinement.⁹¹

Returning to the treatise *Diseases* and its directives for empyema, at 2.47P the previously lanced pus pocket is then to be infused with a solution of warm wine and oil through an *auliskos*. In *Affections* 21P we find ileus being treated by inflating the blocked intestine with an apparatus consisting of a small bag of animal skin attached to an *auliskos* (αὐλίσκον προσδήσας πρὸς ποδῶνα ἀσκίου) before administration of an enema. The same general remedy is applied to this condition in *Diseases* 3.14P, but there a blacksmith's bellows (χαλκευτικὴ φῦσα) is used for inflation prior to the enema.⁹²

Another name for tubes come upon in the *Hippocratic Corpus* is *motos* (μοτός). As is sometimes true of Hippocratic probes, a peculiarity of this name is the frequent stipulation of the material of which it should consist: tin or

89 The term *katheter*/καθετήρ, which was later standard and which one would expect to encounter in Hippocratic writings, does occur, but only once, and then not in the sense of catheter. Rather it is applied to a series of three linen pessaries, also called *mota*/μοτά, annointed with goose fat and inserted to soften sclerotic womb. See *Diseases of Women* 8.157.9–10L where application of this linen *katheter*/*motos* is compared to the type of *motos* used in the treatment of empyema, as in *Diseases* 2.47P.

90 See Max Wellmann: *RE*, s.v. "Erasistratus;" Gurlt (1898) vol. one, zweiter Buch, 309.

91 Or was it simply that he was remembered for applying the S-shaped catheter in certain situations? So Caelius Aurelianus, *Chron. Diseases* 2.1.13: *praeterea etiam peritioneo paralysi vitiat, ut Erasistratus ait, urina abstinetur et neque excluditur nisi adhibito catheteri*.

92 Caelius Aurelianus, like Soranus, rejects this approach but supplies the Latin terminology for it: *folliculo artis aerariae . . . ex aerario folliculo* (*Acut. Diseases* 3.17.154 & 156). A tube was likely attached to the bellows; such was the stipulation later by Alexander of Tralles who requires an *auliskos iatrikos* (αὐλίσκος ιατρικός; *Therap.* 2.363.20).

lead. For example, in the famous passage on empyema (*Diseases* 2.47P; see also 2.60P) a tin *motos* is inserted after the pus pocket has been punctured, preliminarily drained, and washed out with an *auliskos*. The purpose of the *motos* in this operation is to complete the drainage of the pocket and to allow the ulcer to heal.⁹³ It is clearly not meant to be a permanent part of the physician's instrumentarium as it is cut off piece by piece as the ulcer knits. In *Diseases* 2.59P we encounter another *motos* of tin, though this one is solid (μοτὸν στερεὸν κασιτέρινον). Its purpose is to prevent adhesions by being positioned in wounds of the ribcage or incisions for empyema. The same motive likely accounts for the creation of a piece of lead (μόλιβδον ποιησάμενος) smeared with honey and placed in the nostril after removal of a polyp (*Diseases* 2.33, 36 & 37P). The term *motos* is not used here, but clearly a tube is required. A tube called *motos* is also found in administering to female complaints, in this case a uterus displaced toward the hipbone. As part of the treatment a lead *motos* is fashioned, filled with the kneaded fat of a ewe and inserted to soften the cervix (*Diseases of Women* 8.133.103–114L).⁹⁴ Elsewhere the term is used to designate a tent of linen used in the main as a plug in dealing with various maladies.⁹⁵ With *motos* we may include *balanos* (βάλανος). Ordinarily *balanos* designates a plug or pledget of medication; but once it is said to be made of horn (βάλανον ἐνθεῖς κερατίνην), smeared with fullers earth and inserted rectally in combating fistula (*Fistulas* 3P). In this instance, therefore, the *balanos* must be a tube.

Speculum?

Finally: in addition to the aforementioned graduated probes employed in dilation of the cervix, we also hear of a device performing a similar function for treatment of rectal maladies such as fistula and piles. It is referred to solely in *Hemorrhoids* 5P and *Fistulas* 3P where it is called *katopter* (κατοπτήρ).

Authorities writing at the time of the Roman Empire amply record a rectal/vaginal dilator to which they gave various names including 'small speculum' (μικρὸν διόπτριον).⁹⁶ Included in some instrumentaria extracted both from Roman graves and settlement sites is an apparatus consisting of two handles, each terminating in a projecting valve and rotating on a pivot (e.g. Fig. 73). The device was operated like a forceps by compression of its handles, which action

93 Drainage for this condition had to be gradual; see *Aphorisms* 4.6.27L.

94 ὁκάταν δὲ ποιηθῇ ὁ μοτὸς ὁ μόλιβδινος, στέατος αὐτὸν ἐμπλήσαι διὸς τετρίμμενου—.

95 As above in treating sclerotic cervix at *Diseases of Women* 8.157.1–15L.

96 These include διαστολεύς, τὸ μικρὸν διόπτριον (Oribasius, *Coll. Med.* 44.20.66), and ἐδροδιαστολεύς (Paul 6.78.4 [Leonides]). For the link see Galen, *Hippocratic Glossary* 19.110K.

forced the valves apart. While no Roman source (with perhaps the exception of Celsus)⁹⁷ ever describes the instrument, the fact that it is termed ‘small’, in contrast to the larger uterine speculum available to Greco-Roman physicians, and the close resemblance of Roman survivals to modern versions of the rectal speculum make the identification certain.⁹⁸ As Galen did not hesitate to identify the imperial terms with the Hippocratic *katopter*, these surviving bivalve dilators have generally been seen as representing both the Roman and the Hippocratic instrument in question. However, the fact that Celsus only describes but does not name the instrument has prompted the suggestion that it may only have been recently developed, at least in the form assumed by the surviving examples.⁹⁹ If so, the Hippocratic *katopter* may have been something else, perhaps only two large spoons, the operator holding one in each hand as he enlarged and examined the rectum. The first century Hippocratic commentator Erotian may have understood *katopter* in this sense when he equated it with a spoon probe.¹⁰⁰ One might also expect to hear of the *katopter* in connection with vaginal and uterine examinations in the Hippocratic gynecological treatises, which, however, are silent on the issue.¹⁰¹ Still, the concept of an instrument consisting of two elements revolving on a pivot was familiar to the Hippocratics who, as we have seen, mention the tooth forceps, as does Aristotle (*Mech.* 854a17); furthermore the language used in *Haemorrhoids* 5P, “when (the *katopter*) is being opened (διωγόμενος) . . .”, certainly allows for a speculum operating on a pivot. The matter is presently irresolvable and underlines the difficulties of treating Hippocratic surgery without the benefit of contemporary instruments to compliment Hippocratic texts.

If the *katopter* was a speculum in the modern sense, it would, being useless for much else, represent along with the cupping vessel one of the few

97 Celsus (7.5.2B) remarks on an instrument used in extraction of impacted arrowheads. He gains access to the missile by dilating the wound with a device that he compares to a letter of the Greek alphabet (*ferramento ad similitudinem facto Graecae litterae*). Unfortunately, the figure of the letter has dropped out of the text. However, there is strong feeling among scholars that the Greek letter in question was upper case epsilon (‘Y’). The shape assumed by the instrument cited above, when its valves are open and its handles completely compressed, is exactly the configuration of epsilon.

98 See, for example, the rectal specula advertised in *Catalogue of Surgical Instruments of Superior Quality*, Biddle and Crowther Inc. 321 Seneca St., Seattle, Wa. 1935 (24th ed.), p. 58.

99 Jackson (1991).

100 κάτοπτρον: ἢ μῆλωτίς. (*Hippocratic Glossary* 90.15). I assume here that κάτοπτρον = κατοπτήρ.

101 Oribasius (*Coll. Med.* 44.20.66) and Paul (6.78.4) allow that this type of speculum was also useful for dilation of the female organs; see below: Tools of the Empire: Gynecological and Obstetrical Instruments, Small (Rectal) Speculum.

instruments in the Hippocratic arsenal manufactured solely and permanently for surgical applications.

'Hippocratic' Survivals

One question remains. Why, other than the few cupping vessels cited, are there so few recognizable surgical tools surviving from the fifth and fourth centuries BCE.¹⁰² These cups from graves show that it cannot be because, unlike the physicians of the Roman Empire, Hippocratics were never buried with instruments. On the contrary they clearly sometimes were. So there must be other reasons for their infrequency. One may have been a greater scarcity of metal during the fifth and fourth centuries, which, in this case, would have precluded wasting good metal tools by interring them with a corpse. But there may be a weightier reason. If it is true that not infrequently the Hippocratic employed items not intended for medical purposes, or even created what he needed on the spot, then there were simply fewer instruments specifically created for surgical purposes. *Joints* 4.7.43L nicely expresses this tendency: "you always have to use whatever is at hand."¹⁰³

Finally, the *sikua* always takes pride of place on the coinage of Greek cities especially associated with the medical art, and the same applies to votive and gravestones, including the late archaic stone in Basel cited at the beginning of this paper.¹⁰⁴ It seems, therefore, that the cupping vessel was the one item available in Hippocratic times that was particularly symbolic of the surgical art; hence it was the item of choice for burial purposes when one considered appropriate grave furniture for a deceased physician in those singular instances where a physician was so honored.

102 Lambrinoudakis (1976) proposes a few blades from the shrine of Apollo Maleatas, Epidaurus. See also now the Pydna grave in Dasen (2011) 14–15.

103 Χρέεσθαι δὲ χρὴ αἰεὶ τοῦτοις ἃ ἐν τύχῃ παρεόντα. One also thinks of Herodotus' account of the famous Democedes of Croton who carried on without any instruments at all (3.131). The knives and forceps said to be "for doctors/healing" in *IG* II² 47 (early 4th cent. BCE), lines 16–19 give some pause for thought. But the meaning of ἱατρικὸς-ά may mean simply that these tools were dedicated by a doctor who used them in his practice.

104 In a few cases a forceps also appears. Lambros (1895) 15–19 has most illustrations of both; see also Penn (1994) 141–143. For Ialysos see Berger (1970) 19–23.

The Hellenistic Contribution

The Hippocratic surgeon attempted to minister to various infections, growths, and lesions along the surface of the body and, where accessible, in its orifices. Thus, in addition to cupping and bleeding, we find him applying or introducing numerous medicaments and solutions with probes and tubes, inserting the catheter, operating on tonsil, polyp, fistula and hemorrhoid with knife, needle, forceps and cautery, and even cutting into the body to puncture and drain ascitis and empyema. Among his most daring procedures he might deploy drills, levers, saws and scrapers to trephine the skull, reduce fractures or perform minor amputations. And, clearly, he was much preoccupied with female complaints, accessing the organs of reproduction with dilators, medicating with probe, pessary and clyster, and even dismembering and extracting a lifeless fetus. Still, anyone interested in the surgical texts of the Roman Empire soon realizes that there are more names for instruments and more adventuresome operations attested in the texts of that period than we find in the *Hippocratic Corpus*. A cursory reading of the sixth book of Paul of Aegina demonstrates this amply. Note, for example, Paul's surprise at the reluctance of Hippocratics to reduce fractures and dislocations complicated by wounds (6.107 and 121). In contrast, he and the surgeons of the early Empire on whom he depends are prepared to perform lithotomy, mastectomy, major reductions and amputations, and surgery for goiter, severe trauma and various hernias.¹ In short, the Hippocratic surgeon was less well equipped and, however admirable his sense of enterprise, less capable. Moreover, the dearth of recovered Hippocratic tools contrasts sharply with the professionally prepared, and permanently available instruments extracted from Roman graves and sites, beginning with the Vesuvian cities buried in the eruption of 79 CE.

Now many, if not most, of the instrument types recovered at Pompeii and her sister cities must have been in common use well before 79 CE. At least a generation earlier we find all but a few in the *De Medicina (On Medicine)* of A. Cornelius Celsus. In fact this work, especially its 6th through 8th books, is the first major tract we have dealing extensively and generally with surgery. More crucially it fills the gap between the *Hippocratic Corpus* and the first century of the Roman Empire: in fine Celsus offers us a summary of surgical

¹ Including post-traumatic excision of herniated liver or lung (Soranus, *Gyn.* 4.40.1 Ilberg = 4.6.179–181 BGM).

developments in the Hellenistic age. To judge by the rich instrumentarium known to him, these developments were considerable.²

To cite some examples: in the pages of Celsus we hear for the first time of the dissector (*manubriolum*) so familiar on the scalpels of the Empire (7.6.4, *stomatoma*), of a spatula-like blade for perforating dropsy (7.15.1), of a knife called 'crow/raven' applied in cases of scrotal hernia (7.19.7–8), and of yet another invented by one Meges for lithotomy (7.26.2N–O).

It can be debated whether retractors were much employed in Hippocratic surgery outside of embryotomy. The hook or *helkuster* used in embryotomy by Hippocratics reappears in Celsus but now in company with an *uncus* sharp on its inner side for decapitation of the fetus (7.29.7). In addition we find frequent mention of sharp (7.7.4B) and blunt (7.31.2–3) *hamuli* or hooks/retractors in many operations. Lithotomy, only mentioned in passing in the *Hippocratic Oath* (4.17L), now is performed with a roughened retractor (*uncus*) for extracting bladder stone (7.26.2K–L), and with a special instrument for crushing calculus, perhaps a chisel, invented by one Ammonius, called 'The Lithotomist' (7.26.3B). Celsus also directs us to an *uncus* (probably a scoop) designed to extract nasal polyp (7.10.1) and to a special scoop associated with Diocles for the retraction of impacted weaponry (7.5.3A–B).

Forceps (*volSELLa*), rarely attested in the Hippocratic Corpus, save for certain heavy-duty types, now abound. Though Celsus is stingy with descriptive language, the different jaw types on forceps surfacing at Pompeii can be teased out of his directives for the surgeries involved: e.g., pointed (7.12.1D, bone fragments), dentated (7.12.3, uvulectomy), and mounted on powerful cross-legged or pliers-like models (7.5.2B & 8.10.7G, imbedded missile points and fractured bones). In dealing with tooth extraction he is for once specific, referring explicitly to the Greek *rizagra* or pliers-like forceps for extracting a broken root (7.12.1F).

The few references to Hippocratic needles are augmented in *De Medicina* where five different kinds are deployed in over a dozen situations, these in addition to suturing wounds and sewing up bandages. In particular Celsus describes an iron needle shaped like a lancet for cauterization in cases of trichiasis (7.7.8B) and one pointed but not too fine for couching cataracts (7.7.14D), surgeries not attested for Hippocratics. As with the forceps, Celsus is equally reticent to supply modifiers in his frequent references to the probe (*specillum*). He does, however, mention a roughened (*sp. asperatum*) model for eye treatment (6.6.27) and one associated by nomenclature with cleaning ears (*sp. oricularium*) but used surgically by him in such processes as levering

2 I here owe much to the useful summary by Jackson (1994).

out bladder stone (7.26.1C). The *specillum oricularium* must, then, have been equipped with a spoon or scoop, and the name must have covered the various spoon types buried in the eruption of 79 CE.

As in the Hippocratic Corpus, references to the cupping vessel and the cautery (*ferrum/ferramentum candens*) abound in Celsus, though, in contrast to the Corpus, Celsus offers less detail as to cautery types, save for the spear like model just mentioned for trichiasis. On the other hand, he offers a full description of the catheter tube and its proper insertion in the case of both males and females (7.26.1C). It is likely too that the tubes (*cannulae*) inserted to drain empyema and dropsy in both the Corpus and in Celsus (7.15.2) had been improved upon by the time of the latter to judge by the remarkable specimens found (probably) at Herculaneum (Fig. 1, middle row, 2nd and 3rd from left; Fig. 60). New types also emerge in the form of what may be a plunger driven clyster, again associated by name with irrigation of the ear (*oricularius*) but with wider applications, such as washing out a fistula or injecting solutions, such as vinegar and soda into the bladder through the incision made in lithotomy (5.28.12M; 7.26.5E).

If we focus on bone surgery, the drills and scrapers found in the Hippocratic *Joints, Fractures* and *On Head Wounds* emerge again in *De Medicina*. But, Celsus now knows of a special guard, called by Greeks *meningophulax*, to protect the brain in skull surgery (8.3.8–9; 8.4.17). Curiously he does not mention the levers got up for the purpose that we see as far back as *Joints* and *Fractures*, but they were clearly available to him. To judge by the type we see emerge at Kalkriese in connection with the defeat of Quintilius Varus in 9 CE, they are already identical to the fine professionally prepared pieces recovered at Pompeii (Figg. 50–51).³ Furthermore, the reluctance to amputate in the *Corpus* is replaced in the *De Medicina* with a confident and detailed description of the procedure. It has been conjectured that underlying this confidence were techniques developed in the Hellenistic period for ligating blood vessels.⁴

We have touched above on gynecological surgery. Obviously, internal access to the female organs was a key factor in the extent to which they could be treated. Other than graduated probes, it is possible that some sort *speculum*-like dilator was known to Hippocratics.⁵ But whatever this device was, it is

3 For these levers see under Tools of the Empire: Bone and Tooth Instruments, Bone Lever/Elevator.

4 So Majno (1975) 191–192, 328, although Hippocratics are not quite as inept at amputation as he makes out. See also Gurlt (1898) vol. one, zweiter Buch 293.

5 See above, Hippocratic Surgeries and Surgical Tools (Gynecological Tools) and Bliquez (2010) 36–38.

not associated in the Corpus with gynecological procedures. In contrast finely tooled professionally prepared uterine specula were certainly available before 79 CE, to judge by the remarkable survivals from Pompeii and Herculaneum, including one quadrivalve, two trivalves and two smaller bivalve types that may have served for vaginal as well as rectal purposes (Figg. 70–73). Celsus may be first witness to the existence of the bivalve type when he mentions a mysterious instrument shaped “like a Greek letter” (7.5.2B). If that letter was an upper case upsilon, the mysterious instrument would indeed resemble the bivalve speculum with its valves open, just as the Greek uppercase Y.⁶ Oddly, Celsus does not connect this instrument with proctology or gynecology, only with extraction of missiles; and he never mentions a trivalve or quadrivalve uterine model at all. Indeed we never hear in the literature of any such device before it is dealt with by Soranus of Ephesus (2nd cent. CE). Yet, all of the Vesuvian *specula* were clearly in use before 79, surely well before. The question is, when were these marvelous instruments of dilation developed?

While certainty is impossible, such evidence as we have pulls one toward the third century BCE and to Alexandria. At this time substantial advances in understanding human anatomy were roughly contemporary with interest in screw driven devices.⁷ Figures like Herophilus of Chalcedon were taken up with gynecology and, whether he, in particular, had anything to do with worm driven *specula*, someone with similar interests may very well have had.⁸ Turning to urology we can connect Herophilus’ younger contemporary, the renowned Erasistratus of Iulis, with the catheter, which if not actually his invention, must have been improved upon by him, or perhaps found useful for more procedures.⁹ Similarly, it would be no surprise if Celsus’ plunger driven clyster tube was developed in a century when piston driven pneumatic devices were being explored.¹⁰

The fact that Celsus never mentions bone levers and worm driven *specula* should warn us against placing too much weight on his silence. Figures like Diocles, Meges, and Ammonius were fortunate to be incorporated into his narrative in conjunction with instruments they invented. Surely many others who were deserving, but perhaps unknown to him, were responsible for the advances in the *specula*, retractors, forceps, needles, probes and tubes (includ-

6 See Spencer, Loeb edition, vol. 3, 316 note b; Jackson (1991).

7 Bliquez (2010) 36.

8 For Herophilus’ interest in female anatomy and midwifery see von Staden (1989) 365 ff.

9 See the discussion s.v. Catheter, in *Tools of the Empire: Tubes*.

10 Bliquez, Oleson (1994).

ing those for injection) developed between the fourth and first centuries BCE. These practitioners remain anonymous, but their contributions and those of their Hippocratic predecessors underlie the rich supply of the tools assuming consistent forms and professionally prepared for the surgeons of the Roman Empire.¹¹

11 I do not discount the possibility that some improvements in design may have occurred as late as the reign of Augustus in a military context. For this view bearing on scalpels, ear scoops, levers and the spatula see E. Künzl (1991b). Nor should consistency of form be considered universal. There must always have been a certain amount of local variation, as with the kit from Stanway, UK; see Jackson (1996) and (2007a).

Tools of the Empire

Cupping Vessels

We begin appropriately with the cupping vessel, as it, along with the probe, is the instrument most frequently cited in the literary sources. The terminology used to identify it is amazingly consistent. Because of its resemblance to a gourd, the Greeks always called it σικύα/*sikua*, while in Latin the term *cucurbita* or its diminutive *cucurbitula* was commonly used.¹ To distinguish gourds and cupping vessels the names ἱατρικὴ σικύα and *cucurbita medicinalis* were sometimes applied.² References to the instrument extend from the *Hippocratic Corpus* to Byzantine sources, including *Lists*.³ Representations of it on stone occur well before it is mentioned in the literature, the earliest being a late archaic (ca. 500 B.C.) relief in Basel.⁴ The cupping vessel is commonly depicted

- 1 Greeks sometimes also compared the shape of the instrument to the womb (Soranus, *Gyn.* 1.9.1 Ilberg = 1.4.43–44 BGM; Rufus, *Parts of Human Body* 64.3; Oribasius, *Coll. Med.* 24.31.7). On the Latin side Juvenal 14.58 applies to *cucurbita* the adjective *ventosa*, apparently to describe the sucking sound made when the instrument was removed. At some point *ventosa* alone as a noun came to designate the instrument, and this is the term we find in Romance languages. Using *ventosa* as a noun are Theodorus Priscianus (ca. CE 364–375; see John Scarborough's entry "Theodorus Priscianus" in Keyser and Irby-Massie [2008] 787–788), *Euporist.* 2 (*Logicus*) 17 & 87, and Isidore of Seville (7th century), *Orig.* 4.11: *Guva, quae a Latinis a similitudine cucurbita, a suspirio ventosa vocatur. Guva* must derive from Greek κούφη/α; cf. e.g. Caelius Aurelianus, *Acut. Diseases* 3.21.200–201: *cucurbitas leves, quas Graeci cuphas vocant.*
- 2 E.g. Plato, *Timaeus* 79e10; Soranus, *Gyn.* 1.9.1 Ilberg = 1.4.44 BGM; Cassius Felix 21.4; Marcellus Empiricus, *De Med.* 10.4. Pseudo-Galen several times uses the variant σικύα (*Medical Definitions* 19.458K; *Prognosis by Math. Sci.* 19.559K). In his dictionary of Hippocratic terms (*Hippocratic Glossary* 19.137K) Galen says that the ἱατρικὴ σικύα could also be called σικυώνη, though σικυώνη in this sense seems confined to a passage in *Diseases of Women* 8.222.35–38L, which may or may not be a dependable witness. If the Σηκυιαστήριον entered in the Byzantine lexicon of John Zonaras 1638 (Tittmann) is a diminutive for σικύα, the name σικυιαστήριον may also have circulated. The term κύαθος ("ladle, spoon") in Aristophanes, *Lys.* 444, *Pax* 542, and [Aristotle] *Prob.* 890b7 was erroneously accepted as another name for cupping glass by Milne, among others, and, consequently, is sometimes so translated; see Bliquez (1998).
- 3 Fischer (1987) 37(42).
- 4 See Berger (1970) 19–23; the earliest survivals from Ialysos also date to this time (see below).

on coins and on grave and votive monuments.⁵ More than any other instrument it was used as a symbol of the medical art.

The fullest account of cupping is found in Oribasius (*Coll. Med.* 7.16, much of it from Antyllus), condensed by Paul (6.41). The account of Celsus (2.11Ser) is the most replete source in Latin. From these authorities we learn that metal cups were made in the main of copper alloy. These were the most efficient type, and their popularity and durability surely account for the fact that only they survive. Antyllus also mentions silver models (Oribasius, *Coll. Med.* 7.16.13) and the scholia to Nicander, *Theriaca* 921 an iron model. To judge by what Lucian says (*Ind.* 29), silver types must have added sparkle to a physician's instrumentarium, but Antyllus dismisses them as taking the heat too readily. In addition to metal cups, Antyllus also attests cups made of glass (Oribasius, *Coll. Med.* 7.16.13; Paul 6.41.2). He says they have the advantage of clearly revealing the amount of blood extracted, but Paul notes that they do not take the heat well and can break. Celsus says that, in a pinch, even a small household cup or pot-tage bowl (*caliculus quoque aut pultarius*) can be used, if it has a narrow mouth (2.11.2Ser; cf. also 5.27.3B). Caelius Aurelianus too allows for clay cups (*ambices*) in treating diseases of the colon (*Chron. Diseases* 4.7.94); even vessels like amphoras, which he says may be made of glass, can be applied in cases of ileus when a metal cup might be too heavy for the patient (*Acut. Diseases* 3.17.150). Finally, in treating pleuritis Aretaeus refers to a broad heating vessel applied "like a cupping vessel" (ὡς τρόπος δὲ σικύης). This, he says, could be of clay or of copper alloy (*Care Acut. Diseases* 1.10.15).

According to Paul cups varied considerably in size (6.41.3), Antyllus noting that the greatest variation in shape occurs among cups of copper alloy (Oribasius, *Coll. Med.* 7.16.15). Often Greek authors direct practitioners to apply larger models, using terms like σικύα μεγάλη (Galen, *Meth. Healing* 10.964K = J-H 3.452–453), εὐμεγέθης (Paul 3.38.1), μεγίστη (Aëtius. 12.1.334), and ὡς μεγίστη (Paul 3.39.2). There are several references to the shapes of their mouths (στόματα) or lips (χείλη), variations allowing cups to be applied to virtually every part of the body (see summary below). Thus, we hear of cups said to be wide mouthed (πλατύστομος σικύα, Soranus, *Gyn.* 1.50.3 Ilberg = 1.17.78 BGM; *osculo latiores*, Caelius Aurelianus, *Acut. Diseases* 3.17.149), while Antyllus attests flat lipped models (σικύαι ἐπίπεδα ἔχουσαι χεῖλη) and types with lips bent upward or arched (σσεμωμέναι τὰ χεῖλη).⁶ Unsurprisingly, the former are said to be better suited for flat surfaces, the latter for uneven ones. Antyllus goes on to mention types featuring thinner or keener mouths (ὀξύστομοι) that

5 For the monuments, in addition to Berger (1970), see Tabanelli (1958), Jackson (1988) and Hillert (1990). For the coins see Penn (1994).

6 Oribasius, *Coll. Med.* 7.16.15.

draw strongly and are not employed with scarification (see below); with these he contrasts models with blunt mouths (ἀμβλυοχείλεις), the latter to be used on the head. He also states that longer models (ὕψηλότεραι) draw more strongly, while those that are shorter (ταπεινότεραι) draw with less force and are better suited to the head (Oribasius, *Coll. Med.* 7.16.15). For greater drawing power Paul prefers cups with longer necks and broader bellies (6.41.3).⁷

There were two basic methods of cupping. In the first the cup was applied without an incision. Since no blood was let, modern translators render this process as ‘dry cupping.’⁸ In contrast, if there was scarification, that is, if the skin was cut in advance, an operation that went by a number of names (see below), translators use the term ‘wet.’ In theory, the purpose of cupping, if wet, was to extract corrupted blood or matter, or to divert an excess of blood causing a disease or condition; if dry, a milder intervention, the goal was to stimulate or attract. Galen nicely summarizes the conditions remedied by cupping. They include drawing up deep seated humors, relieving pain, flatulence, swooning, menstrual problems, reducing fever, stimulating appetite, bracing a weak stomach and arresting hemorrhage (*Leeches, Revulsion, Cupping, etc.* 11.320–321K).⁹

Initially the cup had to be heated. Celsus drops burning lint (*linamentum ardens*) into the cup for this purpose, while Paul heats with a wick (ἐλλύχινον).¹⁰ The cup was then placed on the appropriate part of the body.¹¹ As the cup

7 ὥσπερ καὶ τὰς μακροτραχήλους τε καὶ τὸ κύτος εὐρυτέρας ὀγκιμωτέρας τῶν ἄλλων ποιητέον. So also the Hippocratic works *Ancient Medicine* 1.22.14–20L and *Physician* 7P.

8 *Cucurbitulae sine ferro* (‘cups without a knife/cutting’) is a favorite expression of Celsus for dry cupping: cf. 3.27.1D (stroke); 4.14.2 (pneumonia); 4.19.2 (coeliac disease); 4.21.1 (ileus).

9 Cf. also Celsus, 2.11.3–4 where there is an informative section on the theory behind dry cupping. For a brief summary treatment of Galen’s views of the circulatory system and his graded cupping techniques to move blood around the body see Scarborough (2010) 250–251. Again, the chapter in Oribasius (*Coll. Med.* 7.16, much of it from Antyllus) condensed by Paul (6.41) is instructive.

10 Milne (1907) 102 thought on the basis of Aretaeus, *Care Acut. Diseases* 1.10.15 that cups were fueled by oil, and he speculated that they were bellied out for this reason. But Aretaeus is only describing a heating device that had characteristics of a cup.

11 The terminology for employment and application of a cup is legion: In Hippocrates the preferred phrase is σικύην προσβάλλειν. This phrase is frequently retained by later authors but became only one of many expressions used to describe the process. Examples include: σικυάζω (Paul 5.2.1), σικύαν(ας) ἀντερείδειν (Aretaeus, *Care Acut. Diseases* 2.11.4), ἐπιβάλλειν (Paul 2.59.1), προσβάλλειν (Galen, *Leeches, Revulsion, Cupping, etc.* 11.319K), κολλᾶν (Paul 3.31.2.15), προσκολλᾶν (Aëtius 6.39.34), προσφέρειν (Galen, *Cmpds. by Place* 12.665K), τιθέναι (Paul 4.28.1.13), ἐπιτιθέναι (Paul 3.23.1.30), προστιθέναι (Paul 3.23.13.7), παραλαμβάνειν (Paul

cooled a vacuum was created; this in turn caused the cup to adhere and to suck or pull.¹² Anyone who has placed the hot hollow lid of a pan on a smooth surface and then tried to extract it after a few moments will readily understand the process. The vacuum could be made more or less intense by the degree to which the cup was heated: greater heat created a stronger vacuum. In these cases the cup was said to be applied ‘with much/more fire’: in Greek μετὰ φλογὸς πλείονος, μετὰ φλογὸς πολλῆς, μετὰ πυρὸς πολλοῦ, σὺν πολλῇ φλογί, ἅμα δαψιλῇ φλογί, μετὰ φλογὸς δαψιλοῦς, διάπυρος; in Latin, *cum multa flamma*, and *plurima cum flamma*.¹³ Writers occasionally warn of the discomfort and danger of too much pull.¹⁴ When this is a problem (especially around the female breasts), the pressure can be eased: in some instances by applying a sponge dipped in hot water to the surface of the cup; in others by drilling a hole in it.¹⁵ Soranus’ remedy is to insert a thin spatula probe between the mouth of the cup and the bodily surface (*Gyn.* 3.11.5 Ilberg = 3.2.158–161 BGM). For less pulling action, Antyllus directs the physician to apply a moderately heated cup (μετὰ μετρίου πυρός). It was not always necessary to heat the cup with fire; hot water could also be used (Alexander of Tralles, *Therap.* 2.83.25; Paul 3.23.1.30).

To return to nomenclature: In the event of dry cupping, the ancients referred to the cups as ‘light’ (κοῦφαι, ἔλαφραι, *leves*) or ‘without scarification’ (χωρίς

3.72.3.1), παρέχειν (Leon Iatrosophistes, *Consp. Med.* 6.16.6), προσάγειν (Paul 3.9.3.22), ἐρείδειν (Galen, *Meth. Healing* 10.332K = J-H 2.40–41) and σικύαις χρῆσθαι (Paul 3.14.2.30). Latin terminology is similarly replete, often involving direct translation from the Greek: *cucurbitulam adcommodare* (Celsus 7.2.1), *cucurbitas affigere* (Caelius Aurelianus, *Acut. Diseases* 1.11.76), *infigere* (Caelius Aurelianus, *Acut. Diseases* 3.21.200), *defigere* (Celsus 4.21.2), *apponere* (Caelius Aurelianus, *Acut. Diseases* 3.17.149), *imponere* (Celsus 2.11.2Ser), *imprimere* (Celsus 2.11.1Ser), *dare* (Cassius Felix 75.2), *agglutinare* (Celsus 7.26.5B), *conglutinare* (Cassius Felix 1.5), and *admove* (Celsus 4.2.8).

12 Hence the riddle about bronze being fastened to a man by fire in Aristotle, *Poetics* 1458a29–30. The drawing power of cups is sometimes employed analogically: e.g. for breathing by Plato, *Timaeus* 79e10 (with Galen, *Comm. Plato's Timaeus* 19.2 [Schröder p. 24]) and Pseudo-Galen, *Hist. Phil.* (in H. Diels, *Dox. Grae.* 1879 103); for attraction of blood to strong fever by Galen (*Comm. Hipp. Aph.* 18a.103K); and by Alexander of Tralles in describing various headache conditions (*Therap.* 1.469.13; 1.487.2; 1.489.9). Oribasius via Galen records the curious sensation of males that in intercourse the uterus pulls like a cup (*Coll. Med., Lib. Inc.* 10.3).

13 In addition to Antyllus in Oribasius, see respectively for examples: Paul 2.55.1 & 3.72.3, Soranus, *Gyn.* 3.41.6 Ilberg = 3.12.57–60 BGM, Galen, *Meth. Healing* 10.869K = J-H 3.310–311, *Glaucon, Meth. Healing* 11.114K, and Caelius Aurelianus, *Acut. Diseases* 1.11.76 & 3.21.202.

14 E.g. Aretaeus, *Care Acut. Diseases* 1.6.6.

15 Oribasius, *Syn.* 1.13.1–2 and Paul 6.41.3.

ἐγγαράξεως, χωρίς κατασχασμοῦ, χωρίς ἀμυχῶν, *sine ferro, sine scarificatione*).¹⁶ ‘Light’ cups could be applied in a ‘gentle’ way (ῥπιαί) or, in the event of a particularly intense application, in a way described as ‘vehement’ or ‘bracing’ (σιχύαι σφοδραί, εὔτοναι).¹⁷ As noted, the intensity of the application had to do with the strength of the vacuum, which depended in turn on the amount of heat involved. In the event of scarification or wet cupping the cups were said to be applied μετ’ ἐγγαράξεως, μετὰ κατασχασμοῦ, μετ’ ἀμυχῶν, μετ’ ἀμύξεως, or *cute incisa*.¹⁸ In scarification no vein was opened, as in the more radical intervention of phlebotomy (Celsus 2.11.5Ser). Rather one or more incisions were made in the skin, depending on the amount of blood to be extracted. In making as many as three incisions for evacuating coagulated blood caused by a blow, Paul states that some yoke together three scalpels for the purpose (6.41.2).¹⁹ Apparently the idea is to make multiple incisions of uniform depth. In any event Paul considers the process inconvenient and uses a simple scalpel. Of late, Jackson has suggested that a handle once terminating in three blades represents the arrangement described in Paul (Fig. 17).²⁰ Although incisions might be shallower or deeper depending on the thinness or thickness of the blood (Philumenus, *Ven. Creatures* 7.5.1, Paul 6.43.1), the terms designating scarification seem to admit of no distinction.²¹

Sometimes a cup was used to raise and redden the area to be evacuated before scarification was performed; the cup was then reapplied.²² It might also

16 See respectively: Paul 3.62.2, Oribasius, *Coll. Med.* 7.16.1, Caelius Aurelianus, *Acut. Diseases* 3.21.200, Aëtius 15.2.13 & 16.61.63, Paul. 4.28.1, and Celsus 3.27.1D. The term ‘scarification’ derives from the Latin *scarificatio* as in Caelius Aurelianus, *Acut. Diseases* 3.17.150 & 21.200. For the contrast between light cupping and cupping with scarification, see also e.g. Paul 3.6.2.42 & 3.70.1.12 and Soranus, *Gyn.* 3.32.1 Ilberg = 3.7.73–75 BGM.

17 In addition to Antyllus in Oribasius, see respectively for examples: Galen, *Aff. Parts* 8.154K [Archigenes] and Pseudo-Galen (*Drugs Easily Procured* 14.338 & 339K). The terms ‘light’, ‘gentle’, and ‘intense’ are transferred epithets; that is, the adjectives properly modifying the process are applied to the device used to perform it. It is the cupping that is ‘light’ or ‘intense’, not the cup.

18 See Paul 3.12.2.7 & 3.19.1.27; Oribasius, *Ecl. Med.* 63.9 & 72.1; Celsus 4.27.1D. For scarify Galen once uses the participle παραμύσσω (*Cmpds. by Place* 13.256K).

19 τινές ἐπενόησαν ὄργανον πρὸς τοῦτο τρία σμιλία ἴσα ζεύξαντες ὁμοῦ, ὅπως τῇ μιᾷ ἐπιβολῇ τρεῖς γίνοντο διαιρέσεις...

20 See Ralph Jackson “Back to basics: surgeons’ knives in the Roman world” (forthcoming; see Bibliography).

21 E.g. Galen, *Leaches, Revulsion, Cupping, etc.* 11.317–320K where the terms ἐγγάραξις and κατασχασμός are used indifferently.

22 Antyllus in Oribasius, *Coll. Med.* 7.16.3. See Oribasius, *Ecl. Med.* 73.23 for the use of well heated narrow mouthed cups as rubefacients and to attract deep seated matter.

be applied after leeching. Leeches could be used in place of cups, especially in areas not convenient for fastening the latter. In that case a cup might subsequently be applied to extract their 'poison.'²³ In dry cupping more than one cup might be used, and the cups might be distributed over various parts of the body (Oribasius, *Coll. Med.* 8.6.34). Sometimes they were arranged in patterns, such as a straight line (Aretaeus, *Care Acut. Diseases* 2.5.3) or in a circle (Aëtius 16.73.52–53; Soranus, *Gyn.* 3.32.7 Ilberg = 3.7.73–74 BGM; Caelius Aurelianus, *Acut. Diseases* 1.11.76), or continuously repositioned (Aretaeus, *Care Acut. Diseases* 2.4.5). When applied to hirsute areas, especially the head, the hair had to be shaved off in advance.²⁴

The horns of cattle were also used for cupping. These were not heated; rather the vacuum was created by orally sucking a small opening at the point of the horn. This was then sealed with a finger or wax (Celsus 2.11.2Ser). Horn had greater appeal for patients afraid of fire (Oribasius, *Coll. Med.* 7.16.14). Galen draws a sharp distinction between the *sikua* and horns used for cupping. Clearly he regards the latter as quite different devices.²⁵

A special cup designed by Heron of Alexandria deserves mention (*Pneum.* 2.17). This cup was made of metal and was apparently shaped like the usual *sikua*. It was divided into two sections by a diaphragm. A valve leading into the upper section was used to create a vacuum in it by oral sucking. The cup was then applied and a second valve accessing the lower section was opened. The vacuum thus permeated the entire cup. Medical authors never mention such a complicated cupping device and there is no evidence that it was ever actually produced and used.

While no cups of silver and no horns used for cupping have been recovered, over thirty of the copper alloy types have survived. These include 6 from

23 For this and other details on leeching, see Galen, *Leeches, Revulsion, Cupping, etc.* 11.317–19K, followed closely by Oribasius, *Coll. Med.* 7.21 [Antyllus]. Cassius Felix describes an interesting combination of leeches and cups in his treatment of empyema (21.4). He first places leeches in a cup lined with linen cloth overlapping its mouth and then applies the mouth of the cup to the afflicted part; next he withdraws the cloth, allowing the leeches to fasten on and inject what we call heparin. After removing the leeches by salting, he completes the operation with the same cup, now heated. Leeching is still practiced in modern times. For an interesting example in Eastern Europe, see Stalin's death scene in S. Alliluyeva's *Twenty Letters to a Friend* (20). In America leeches can be secured through Sargent's Drug Store in Chicago.

24 See Pseudo-Galen, *Drugs Easily Procured* 14.342K; Galen, *Causes of Sympt.* 7.142K; Oribasius, *Coll. Med.* 10.15.4; Caelius Aurelianus, *Acut. Diseases* 1.11.76.

25 *Meth. Healing* 10.896K = J.-H. 3.350–351: ὥσπερ αἱ τε σικύαι καὶ τινα τῶν κοίλων κεράτων, οἷς ὥς σικύαις ἔνιοι χρῶνται.

Ialysos (Rhodes), one from Corinth and one from Thebes (Figg. 4–5), all ca. 500 BCE, one from Tanagra, perhaps Hellenistic (Fig. 6), and one lately from Pydna, perhaps as early as the 4th century BCE.²⁶ Roman survivals, all of imperial date, include 14 from Pompeii (Fig. 1, top row; Fig. 7), three from Bingen and single specimens from Corfu, Nea Paphos (Cyprus), Balčik (Bulgaria), Paris, the Gulf of Baratti (Tuscany), Masada and possibly Alliano. All are of the flat mouthed/lips type. Since survivals extend from late archaic Greece to the Roman Empire, the cupping vessel is materially the best witnessed of all Greco-Roman surgical tools over time. As Künzl ([1983a] 21) has observed, the earlier Greek types are less angular in profile at the shoulder in contrast to the sharper accentuation of their Imperial counterparts. Although all of the Roman cups have this general shape, they can be further divided, as for example at Pompeii, into two groups: those narrower and those more rotund in form (Fig. 7). It may be simply that different artisans or workshops account for the distinction, but the testimonia of Paul and Antyllus lead one to speculate that two shapes produced, or were thought to produce, different effects. The specimen from Tanagra (Fig. 6) once had a chain by which to hang and, perhaps, heat it.²⁸ The specimens from Pompeii and from Bingen feature rings at their apex, and rings are clearly depicted on the monuments. Their purpose was, again, for suspension and heating.²⁹ The ring would also have been handy in removing the cup when treatment was terminated.

-
- 26 The Pydna instrumentarium is said to be perhaps as early as the reign of Alexander (356–323 BCE). I only know of it from Dasen (2011) 14–15. Like the Tanagra specimen it is more angular in profile, but it more closely resembles Roman types in form as well as in sporting a ring at its apex.
- 27 See Berger (1970) 66, Lambros (1895) 19–20, and Bliquez (2003) 405–407 for Ialysos, Corinth, Thebes and Tanagra; Spawforth (1990) 9–19 for Baratti; Michaelides (1984) 316 & 319 for Nea Paphos; Künzl (1983a) 43, 75, 81, 110 for Corfu, Paris, Bingen, and Balčik; and Hershkovitz (1996) 171–3 for Masada. Hershkovitz incorrectly sees a Hellenistic cup in a brass boss from Samaria published by Reisner (1924) I 360 fig. 232 1a. For the reconstructed fragments at Alliano, see Baykan (2012) 157(348). Very likely clay or glass models have also come down to us, but are seen as having other functions. A little clay pot and several small glass vessels extracted from graves at Cologne, for example, though logically taken as containers, might have served as cupping vessels; Künzl (1983a) 88(64.1) & 92(70.13–14 = Fig. 86). Also one would like to know everything that was originally included in the ‘glass puddles’ produced by the conflagration at Rimini; see Jackson (2003) 321.
- 28 This can be seen in Milne’s illustration (Pl. xxxiii). The chain was no longer present when I examined the piece in the Athens Museum in May of 2002. There is testimony in the Askepieion inventories to such a chain on a cup: see Aleshire (1989) 44, 158, 321 and *IG* 11² 47.8: σικύα μ[εγ]άλ[η] ἀλυσσει δεδεμένη. Early 4th century BCE.
- 29 Künzl (1983a), cover, illustrates this well.

A second type of cup, long taken as Roman, is much smaller (ca. 3 cm), and its neck is not set off from its body (Fig. 8).³⁰ Künzl (1982a) has shown that the earliest certain evidence for this type occurs only in the fifteenth century. Therefore, though treated as Roman by Milne and others, these smaller types should no longer be included in discussions of classical surgery.

The following selected but substantial gathering of references attests the areas of the body to which cups were applied and/or the conditions for which they were employed. If the operation at any point involved scarification (many require both dry and wet cupping), the source is marked with an asterisk (*). The movement is *a capite ad calcem*.

Head

Aëtius: to occiput for phrenitis (6.2.74* [Posidonius]); to occiput and top of head for deep trauma to eye (7.24.21 = Hirschberg, Waugh pp. 30–31. Chp. 24); to occiput for proptosis of entire eye (7.26.16–17* = Hirschberg, Waugh pp. 32–33. Chp. 26); to occiput plus leeches for suppuration of eye (7.30.17 = Hirschberg, Waugh pp. 36–37. Chp. 30); to occiput for blindness (7.50.37* [Demosthenes, Galen] = Hirschberg, Waugh pp. 80–81. Chp. 50); to occiput for paralysis of eye (7.51.22* [Demosthenes] = Hirschberg, Waugh pp. 82–83. Chp. 51); to occiput for cataract (7.53.16* [Demosthenes] = Hirschberg, Waugh pp. 86–87. Chp. 53); to occiput for dilation of pupil (7.54.16 = Hirschberg, Waugh pp. 86–87. Chp. 54); to occiput for exophthalmos (7.57.11 = Hirschberg, Waugh pp. 90–91. Chp. 57); to occiput for bleeding from the angles (7.65.8* = Hirschberg, Waugh pp. 98–99. Chp. 65).

Alexander of Tralles: to occiput for paralysis of eye (*Therap.* 1.587.14*); to head for melancholy (*Therap.* 1.603.17, an older practice rejected); to aching ear (*Therap.* 2.83.25–85.2); to occiput for pains in head caused by carrarh (*Therap.* 2.97.27).

Caelius Aurelianus: to head for phrenitis (*Acut. Diseases* 1.11.76–78*); to cheeks and gums for toothache (*Chron. Diseases* 2.4.74*).

Cassius Felix: to occiput for cephalaea (1.5*); to shaved occiput for eye trouble (29.5*); to shaved occiput for nosebleed (30.4); to both sides of head by ears for epilepsy (71.3*).

Celsus: to temples and occiput for malarial headache/cephalaea (4.2.8).

30 For these examples in University Museums, Oxford, Mississippi, see Bliquez (1988) 13–14.

Galen: to head for lethargy, insomnia, etc. (*Causes of Sympt.* 7.142K); to head for amnesia (*Aff. Parts* 8.148–155K [Archigenes, disputed by Galen]); to occiput for nosebleed (*Meth. Healing* 10.332K = J-H 2.40–41); to occiput for eye rheum (*Meth. Healing* 10.926K = J-H 3.396–397); to head for lethargy, etc. (*Meth. Healing* 10.931K = J-H 3.404–405); to head for alopecia (*Cmpds. by Place* 12.397K* and 12.415K [Soranus]); to occiput and neck/throat for headache and fever after rectal clyster (*Cmpds. by Place* 12.560K); to occiput for headache (*Cmpds. by Place* 12.570K); application of heat by cup for earache (*Cmpds. by Place* 12.654K [Apollonius]); to occiput for chronic flux in the eyes (*Comm. Hipp. Aph.* 17b.883K*).

Pseudo-Galen: to occiput for eye disease (*Drugs Easily Procured* 14.342K*); to head for nosebleed (*Drugs Easily Procured* 14.419K); to occiput for headache (*Intro. or Physician* 14.739K = Petit 13.21).

Marcellus Empiricus: to occiput for nasal conditions and phlegm (*De Med.* 10.4).

Oribasius of Pergamon: to occiput for torpor/baros (*Coll. Med.* 7.5.19*); to occiput or neck for headache/cephalalgia (*Ecl. Med.* 1.1); to occiput for nosebleed (*Ecl. Med.* 15.1*); probably to head for loss of memory and lethargy (*Syn.* 8.1.5); to occiput for epilepsy (*Syn.* 8.3.10); to occiput for dizziness/skotomatikoi (*Syn.* 8.4.2*); to occiput for inflammation of the eyes (*Syn.* 8.40.2*); to occiput for mydriasis or abnormal dilation of pupil (*Syn.* 8.46.2); to occiput for cataract (*Syn.* 8.49.3* [Rufus]); to occiput for amaurosis and amblyopia (*Syn.* 8.50.2); to occiput for ekpriesmos/exophthalmos (*Syn.* 8.52.4).

Paul of Aegina: to occiput for headache (2.43.1.19); to occiput for lethargy (3.9.3.22*); to occiput for apoplexy and hemiplegia or paralysis (3.18.2.17*); to occiput for dizziness (3.12.2.7*); to occiput for inflammation or boil (3.22.3.13); to occiput for attack of, or persistent flux (3.22.5.30*); to occiput for mydriasis (3.22.27.8); to occiput for cataract (3.22.30.10* [Rufus]); to occiput for exophthalmos (3.22.33.8); to ear for earache (3.23.1.30); to occiput for spitting blood (3.31.2.15).

Throat, Chin, Neck

Aëtius: under chin for paralysis of tongue (6.31.2); to chin for paralysis of gullet/kataposis (6.33.5).

Anonymi Medici: on chin and neck/throat for sore throat/synanche (Fuchs 87–89. P29v–30v* = Garofalo 42–43.7*; 46–47.17).

Celsus: to neck for tetanus (4.6.5*); to chin, throat for angina (4.7.2).

Galen: (likely) to area of inflamed parotid glands to bring up deep-seated offending humors (*Cmpds. by Place* 12.665 & 676K* [Archigenes]); to neck and throat for tonsillitis (*Cmpds. by Place* 12.976K* [Archigenes]).

Oribasius: under the chin for weakness/paralysis of gullet/kataposis (*Ecl. Med.* 73.8); under the chin/anthereon for paralysis of tongue (*Ecl. Med.* 73.9).

Pseudo Galen: (likely) to area of inflamed parotid glands to bring up deep-seated offending humors (*Drugs Easily Procured* 14.334 & 335K).

Paul of Aegina: to first vertebra and chin for paralysis in those areas (3.18.5.8–14); to area of ears for inflammation/tumor called parotis (3.23.13.7); to throat and neck for synanche (3.27.2.8).

Vertebrae, Spine, Back

Anonymi Medici: to vertebrae and the spine for spasms (Fuchs 92.P323* = Garofalo 52–53.5*).

Aëtius: to spine and large vertebra of back to combat strong hiccups/retching after administration of hellebore (3.134.28); to back and spine for lethargy/kataphora (5.121.7 [Herodotus]); from first vertebra to lower back for severe chills/tromos caused by fever (5.134.11 [Herodotus]); to first and second vertebra for unilateral facial paralysis (6.30.11); to back/metaphrenon and sometimes along stomach for stomach trouble caused by black bile (9.2.108 [Herodotus]*); over kidneys for blood in urine (11.3.25 [Archigenes]).

Cassius Felix: between shoulders for tussis arida (34.5*), synanche (37.3*), asthma (41.2*), phrenitis (62.2*) and epilepsy (71.2*).

Galen: to back and spine for injury (*Comm. Hipp. Joints* 18a.561K).

Oribasius: to the first vertebra for unilateral facial paralysis/kynikou spasmou (*Ecl. Med.* 73.7); to back and spine for kataphora/lethargy (*Syn.* 6.33.2 [Herodotus]).

Paul of Aegina: back and spine for lethargy/kataphora (2.42.1.3); over back from first vertebra for shaking/tromos (3.21.1.10); for reduction of displaced vertebra, shown useless by Hippocrates (6.117.2).

Chest, Abdomen, Flanks, Hips

Aëtius: to the abdomen for infections/phlegmonai, not recommended by Galen (3.175.42–43); to the flanks for pain in the loins (5.130.10 [Philumenus]); to abdomen for melancholy (6.10.74* [Posidonius]); to loins for ulcerated tonsils (8.49.20); to ribs for pleuritis (8.76.40–41 & 45*); to mouth of stomach for vomiting of yellow bile (9.3.22 [Philumenus]); above and below the stomach for fainting/lipothumia (9.7.10 [Philumenus]); to abdomen for flatulence/empneumatosis (9.27.43 & 70 [Archigenes, Marcianus]); first away from afflicted parts then on them for ileus & chordapsus (9.28.69 & 131 [Archigenes]); to lower belly for dysuria consequent on fever (11.20.15* [Philumenus]); over bladder for paralysis of bladder (11.24.20 [Archigenes]); over bladder for inflammation of bladder (11.26.29* [Rufus]); to flanks and loins for hemorrhage of bladder and thrombi in it (11.27.17 [Rufus]); to lower abdomen and hips for satyriasis/priapism (11.32.24* [Galen]); to hip for sciatica (12.1.60*, 134*, 337 [Galen, Archigenes]); over navel for flatulence (15.2.13); to each side of the navel for uterine prolapse (16.71.55 [Soranus]); in the area in a circle for uterine flatulence (16.73.52*); to area for uterine induration called myle (16.75.28*); to abdomen for induration of womb/skirosis (16.83.26* [Soranus]).

Alexander of Tralles: to abdomen for pleuritis (*Therap.* 2.233.2*); to stomach for cholera (*Therap.* 2.329.4); to navel for colic (*Therap.* 2.361.24).

Anonymi Medici: to ribs for pleuritis (Fuchs 95.P34v = Garofalo 62–63.8); to chest and ribs for pneumonia (Fuchs 97.P35v* = Garofalo 66–67.1*); to stomach and belly for cholera (Fuchs 107.P42r–42v = Garofalo 92–93.10); to stomach for ileus (Fuchs 109–110.P43r–44r* = Garofalo 96–97.3*).

Aretaeus of Cappadocia: along hip and abdomen/etron for satyriasis (*Care Acut. Diseases* 2.11.4).

Caelius Aurelianus: to abdomen for ileus (*Acut. Diseases* 3.17.150); to stomach and other places for cholera (*Acut. Diseases* 3.21.200–201); to abdomen for diseases of colon (*Chron. Diseases* 4.7.94).

Cassius Felix: to apply leeches to rib cage for empyema (21.4*); stomach for edema (75.2).

Celsus: to abdomen for dropsy (3.21.9*); to chest for tussis (4.10.2); to stomach for flatulence (4.12.2); over praecordia for pneumonia (4.14.1); over stomach for cholera (4.18.5); over abdomen for ileus (4.21.2); to hip for hip-joint disease (4.29.2*).

Galen: to the abdomen for nosebleed, liver for right nostril and spleen for left, both places/splanchna for both nostrils (*Meth. Healing* 10.316, 331–332 & 926K = J-H 2.16–17 & 38–41; 3.396–397); to middle of the stomach for flatulence (*Meth. Healing* 10.869–870, 964K = J-H 3.310–313, 452–453); on liver and spleen for a hemorrhaging nostril and on splanchna if both nostrils (*Glaucon, Meth. Healing* 11.51K); on abdomen for hemorrhages from spleen and liver (*Glaucon, Meth. Healing* 11.69K); to spleen and liver in cases where they have to be treated directly (*Glaucon, Meth. Healing* 11.93K); on navel for abdominal pains caused by flatulence (*Glaucon, Meth. Healing* 11.114K); to stomach for stomach disorders (*Cmpds. by Place* 13.175K [Archigenes]); for liver conditions (*Cmpds. by Place* 13.217K [Archigenes]); for spleen and liver (*Cmpds. by Place* 13.256K* [Archigenes]).

Pseudo-Galen: on liver for right nostril, spleen for left for nosebleed, both for both (*Drugs Easily Procured* 14.338 & 339K); along the midsection for cholera (*Drugs Easily Procured* 14.371K); for nosebleed on the abdomen on the side of afflicted nostril (*Drugs Easily Procured* 14.417K); over navel for stomach pain (*Drugs Easily Procured* 14.451K); on the hip for sciatica (*Intro. or Physician* 14.756K = Petit 13.42).

Oribasius: to abdomen/hypochondrion to promote revulsion in cases of nosebleed and hypermenorrhea (*Coll. Med.* 8.19.3); to abdomen/hypochondrion for epilepsy (*Ecl. Med.* 36.2); to and behind the stomach for fainting/leipothumia (*Ecl. Med.* 47.1); to abdomen for ileus (*Ecl. Med.* 59.3*); to mouth of stomach and both sides of the intestines for elephantiasis (*Ecl. Med.* 76.5); along the overlying parts for arresting female flux (*Ecl. Med.* 148.2); local application for bladder problems (*Ecl. Med.* 63.3, 6, & 9*); abdomen/hypochondria for epilepsy (*Syn.* 8.3.3 & 8.3.10*); light cups to hypochondria πρὸς τὰ πνεύματα for melancholy (*Syn.* 8.6.17); on navel for flatulence (*Ecl. Med.* 58.2 & 4; *Syn.* 9.11.5); on hip for sciatica and to stomach(?) for constipation resulting from treatment (*Ecl. Med.* 74.3* & *Syn.* 9.56.11); large cup to hip for sciatica (*Eunap.* 4.116.7); on flanks toward navel for uterine prolapse (*Syn.* 9.55.2); very large cup continuously on navel for flatulence/pneumatosis (*Eunap.* 4.85.5).

Paul of Aegina: on chest and ribs for inflammation of lungs (3.30.1.16 & 27*); for pleuritis (3.33.2.28); on naval for flatulence (3.38.1.16); on stomach for cholera and diarrhoea (3.39.2.7); all over epigastron for cholic disposition (3.43.4.3 & 9); all over abdomen/epigastron for ileus (3.44.1.11); to flanks/keneones and hips for hemorrhage in consequence of bladder disease (3.45.8.15); over the entire stomach for dropsy (3.48.5.7); unspecified, but probably abdomen for induration of womb (3.68.1.12*); naval and both flanks for uterine prolapse (3.72.3.1); along hip joint for sciatica (3.77.2.15*); on mouth of stomach and abdomen for elephantiasis (4.1.2.25); around navel for inflation of stomach/emphysema (4.28.1.13); to the area for

fractured ribs (6.96.2); along the stomach for cases involving strong purging (7.7.1.11); to stomach in hellebore treatments (7.10.4.20).

Rufus of Ephesus: to abdomen and loins for satyriasis (*Satyriasis, Gonorrhea* 44.1); to loins and under the flanks for inflamed bladder (*Dis. of Kidney and Bladder* 1.12.2).

Soranus of Ephesus: to the area for flatulent uterus (*Gyn.* 3.32.1 & 7* Ilberg = 3.7.32 & 73 BGM); near navel on flanks for uterine prolapse and complications arising therefrom: (*Gyn.* 4.38.3 & 4.39.2 Ilberg = 4.6.138–140 & 4.6.162 BGM).

Female Breasts

Aëtius: for fainting caused by heavy period (5.106.3).

Alexander of Tralles: for heavy period (*Fevers* 1.339.18).

Celsus: for excessive menstruation (4.27.1D).

Galen: to arrest menses or uterine hemorrhage (*Meth. Healing* 10.316K = J-H 2.16–17); for uterine hemorrhage (*Meth. Healing* 10.925–926K = J-H 3.394–395); to arrest menses (*Glaucón, Meth. Healing* 11.51K); for antispasmodic/revulsion (*Leeches, Revulsion, Cupping, etc.* 11.319–20K); to arrest menses (*Comm. Hipp. Aph.* 17b.842K).

Leon Iatrosophistes: to arrest female flux (*Consp. Med.* 6.17.4).

Oribasius: to promote revulsion/antispasmodic (*Coll. Med.* 8.19.3); unspecified but probably breasts for treatment of milk of wet nurse (*Coll. Med., Lib. Inc.* 31.29); to produce best milk for nursing (*Coll. Med., Lib. Inc.* 32.20 [Mnestheus of Cyzicus]); to produce best milk for nursing (*Syn.* 5.4.5).

Paul of Aegina: for milk infection (1.4.1.11); under breasts for cleansing of hemorrhagic womb (3.62.2.14)

Groin, Pubic Area, Thigh

Aëtius: to groin and thighs for fainting spells caused by a uterine condition/diathesis (5.105.4); from kidney area to groin to effect transfer of kidney stone to bladder (11.5.63–65); to loins and under flanks for inflammation of kidneys (11.16.48* [Rufus]); to the pubic area for satyriasis (16.77.16); to pubes and abdomen for inflamed uterus (16.78.73 [Philumenus]).

Alexander of Tralles: to female groin and thighs for hysterical fainting (*Fevers* 1.339.19).

Caelius Aurelianus: to loins and pubes for satyriasis (*Acut. Diseases* 3.18.183*).

Cassius Felix: to groin for uterine suffocation (77.2).

Celsus: to groin for nosebleed caused by failure to menstruate properly (4.27.1D*); groin and hips above pubes to check bleeding after lithotomy (7.26.5B).

Galen: to pubes and groin to arrest uterine hemorrhaging (*Meth. Healing* 10.926K = J-H 3.396–397); to thighs for purpose of diversion/parocheteusis (*Glaucon, Meth. Healing* 11.92K).

Leon Iatrosophistes: to groin for uterine suffocation caused by ascent of womb (*Consp. Med.* 6.20.4).

Oribasius: to groin for insomnia/egregorsis (*Coll. Med.* 6.6.5 [Antyllus]).

Diverse Areas

Aëtius: to last and seventh vertebra and the joint under the shoulder for convulsions caused by fever (5.135.30–33* [Galen]); to occiput and area around first and second vertebra for lethargy (6.3.76* [Archigenes and Posidonius]); to abdomen and back for epilepsy (6.13.47–49* [Galen]); to flanks, abdomen and head for apoplexy (6.27.41 & 57* [Archigenes]); to affected or neighboring parts and head for paralysis (6.28.25, 27 & 75 [Archigenes]); to occiput or neck for headache with fever (6.42.7); for nosebleed to occiput for both nostrils, or to the liver or spleen if hemorrhage is from right or left nostril respectively (6.94.34–35 [Apollonius]); to the abdomen, chest, ribs, back, and first vertebra for severe sore throat (8.50.40–48, 76–78 [Aretaeus and Archigenes via Galen]); to chest, stomach and back for hiccups (9.5.23 [Galen]); from loins to shoulders for gout (12.68.34); to abdomen and groin for scant menstrual discharge (16.61.63*); to spine and armpits to arrest red flux (16.64.67); on groin, thighs and navel on both sides, loins and abdomen for hysterical suffocation (16.67.110, 154*).

Anonymi Medici: to occiput and shoulder?/brachion, also to spine, vertebra, lower back/osphys, chest and upper abdomen, and in the case of women lower abdomen and groin for phrenitis (Fuchs 71–72.P22v–23r* = Garofalo 6–7.5*); on occiput and spine for lethargy (Fuchs 76.P25r* = Garofalo 16–17.6*); to vertebrae, spine, lower

back, chest, upper abdomen and, in the case of women, lower abdomen/etron and groin for epilepsy (Fuchs 78–79.P153r–153v = Garofalo 22–23.5–6); to occiput toward first vertebra, upper abdomen, back, spine to lower back and then upper abdomen, lower abdomen, and groin for apoplexy (Fuchs 81–82.P26r* = Garofalo 28–29.5*); to occiput and first vertebra for persistent headache/kephalaia (Fuchs 84–85.P27v–28r = Garofalo 34–35.4).

Aretaeus of Cappadocia: to back and abdomen for inflammation of lungs/peripleumonia (*Care Acut. Diseases* 2.1.3); between shoulder blades and below on naval with frequent change of position for cholera (*Care Acut. Diseases* 2.4.5); to stomach, to loins as far as groin and to hips for ileus (*Care Acut. Diseases* 2.5.3); to thighs, flanks, hips, groin, spine, between shoulders for hysterical suffocation (*Care Acut. Diseases* 2.10.5).

Cassius Felix: to chest and back for moist cough/tussis humida (33.3); to spine, loins, chest and heart, and in women to pubic area, naval and groin for epilepsy caused by melancholic humor (71.3).

Galen: abdomen/hypochondria and occiput for nosebleed (*Meth. Healing* 10.331–332K = J-H 2.40–41); debate as to whether best to head or chest for phrenitis (*Meth. Healing* 10.929K = J-H 3.400–401); along breasts and to groin and thighs for fainting from uterine disorders (*Glaucon, Meth. Healing* 11.54K).

Leon Iatrosophistes: to groin and abdomen for retention of menses (*Consp. Med.* 6.16.6).

Oribasius: to back and chest, in preparation for administration of opium draft for variety of complaints (*Coll. Med.* 5.19.10 [Philagrius]); to back and mouth of stomach against retention of emetic (*Coll. Med.* 8.6.10 & 34); to spine and under upper vertebra for hiccups in wake of hellebore (*Coll. Med.* 8.6.26–27); to back and abdomen to deal with retention of emetic (*Coll. Med.* 8.6.34); to abdomen and back then head and occiput for epilepsy (*Ecl. Med.* 36.2 & 6*); to breast and back for hiccups/retching (*Ecl. Med.* 38.4); to flanks (keneones) and hips (ischia) for bladder stone (*Ecl. Med.* 63.6); from first vertebra to spine and loins/osphys for shaking/tromos (*Ecl. Med.* 69.1); to hips, last vertebra, back, first vertebra and shoulder joint for spasm in hands and feet (*Ecl. Med.* 71.1*); to neck, spine on both sides, chest, area of bladder and kidneys for tetanus (*Ecl. Med.* 72.1*); to neck or throat/trachelos, spine on both sides, chest and abdomen for tetanus (*Syn.* 8.16.4* [Philumenus]); to groin, thighs and lower abdomen for hysterical suffocation (*Syn.* 9.45.2 [Philumenus]).

Paul of Aegina: to chest, occiput and spine for phrenitis (3.6.2.42*); to occiput, back and abdomen for epilepsy (3.13.2.14, 35 & 38*); for spasms in diverse areas (3.19.1.27*); to neck, spine, chest for tetanus (3.20.2.5*); to abdomen on side of bleeding nostril and occiput for nosebleed (3.24.8.12 & 15*); to groin, abdomen/hypogastrion, loins and flanks for hysterical suffocation (3.71.2.6–3.4 & 12*).

Soranus: to upper stomach and if need be, to back for nausea caused by pregnancy (*Gyn.* 1.50.3 Ilberg = 1.17.76–81 BGM); to abdomen/hypochondria and pubes for menstrual difficulties (*Gyn.* 3.11.5* Ilberg = 3.2.155–163 BGM); to hypochondria and pubes for inflammation of uterus (*Gyn.* 3.23.2* Ilberg = 3.4.133–134 BGM); on groin, pubes and the areas adjacent for hysterical suffocation (*Gyn.* 3.28.3 Ilberg = 3.5.66–68 BGM); on loins, groin, flanks and even hips, if possible, for uterine hemorrhage (*Gyn.* 3.41.6 Ilberg = 3.12.57–60 BGM).

Indeterminate

Aëtius: for tetanus (6.39.34* [Archigenes]); for venomous bite (13.12.15*); for asp bite (13.22.33*); for viper bite (13.23.36*); for bite of dipsas (13.24.15*), for bite of ammodytes or cenchris (13.25, Cornarius).

Alexander of Tralles: for phrenitis (*Therap.* 1.521.5); for synanche (*Therap.* 2.143.25).

Anonymi Medici: for colic (Fuchs 112P45r* = Garofalo 104–105.7*); for satyriasis (Fuchs 113.P46r* = Garofalo 108–109.5*).

Cassius Felix: bite of rabid dog (67.1).

Celsus: for paralysis (3.27.1D); dog and snake bites (5.27.1–3B*); abscess (7.2.1*).

Pseudo-Dioscorides: poisonous bites (*Venomous Creatures* [*Theriaca*] Pr. 130 & 217; 2.36; 19.14).

Galen: for deep seated inflammation (*Constit. Med. Art.* 1.287K); cups and horns used to extract venom (*Meth. Healing* 10.896K = J-H 3.350–351); to suck out poison after leeching tho' leeches preferred to cups for superficial bleeding (*Leeches, Revulsion, Cupping, etc.* 11.318K); for sciatica (*Cmpds. by Place* 13.335K); for excessive pain (*periodynia*) and synanche (*Cmpds. by Kind* 13.507K [Andromachus]).

Pseudo-Galen: for vomiting of bile/cholemesia (*Drugs Easily Procured* 14.564K); for phrenitis (*Intro. or Physician* 14.733K = Petit 13.9); not effective for kidney pain (*Intro. or Physician* 14.748K* = Petit 13.33).

Nicander of Colophon: for poisonous bite (*Theriaca* 921).

Oribasius: for jaundice/ikteros (*Ecl. Med.* 50.2); for nephritis (*Ecl. Med.* 62.1); for satyriasis (*Ecl. Med.* 65.1*); on the part for paralysis (*Ecl. Med.* 73.1); for bites of rabid dogs and poisonous creatures (*Ecl. Med.* 117.5*); after evacuation of whole body (*Syn.* 1.25.8 [Galen]); for cholemesia (*Syn.* 6.41.2 [Philumenus]); for breaks and sprains with ecchymosis/bleeding of small veins (*Syn.* 7.15.3); for inflation/empneumatosis of womb (*Syn.* 9.54.3*); for breaks and sprains with ecchymosis (*Eunap.* 3.30.3).

Paul of Aegina: for vomiting of bile/cholemesia (2.55.1.4); to parts opposite affected area for fainting because of hemorrhage (2.59.1.8); for headache (3.5.7.6); for melancholy (3.14.2.30*); for paralysis Paul (3.18.3.15 & 17); indurated spleen (3.49.4.6*); for satyriasis (3.56.1.19*); for female flux (3.63.2.13); for inflation of womb (3.70.1.12*); for breaks and sprains with ecchymosis (4.31.1.5); to the wound for poisoned weapons or animals (5.2.1.4*); to the wound for rabies (5.3.4.7).

Soranus: for uterine mole/myle (*Gyn.* 3.38.2 Ilberg = 3.11.39 BGM); for female flux (*Gyn.* 3.44.5 Ilberg = 3.13.72 BGM).

Cutting and Puncturing Instruments

Scalpels and Dissectors

As with the cupping vessel, references to the surgical scalpel abound in the literature and representations of it appear not infrequently on monuments.³¹ It is, therefore, not surprising that the scalpel is the most frequently recovered of all the instruments designed primarily for surgical purposes. Virtually every surgical set of any consequence come upon by archaeologists contains at least one specimen. The primary purpose of the scalpel was, of course, to puncture, incise and excise in numerous interventions. But it might also be utilized for dissecting (see below), and likely even for cauterizing (see under Cauteries). Some of the more adventuresome surgeries employing the scalpel include mastectomy, hysterectomy, excision of struma/goiter, and repair of various hernias. For an extensive list of surgeries, see below.

The standard scalpel of the Empire consists of a rectangular handle surmounted by a leaf shaped dissector, all of copper alloy, and a blade of iron

31 See Krug (2008) for more than a half dozen examples on monuments. Fig. 21, 1st and 2nd from left serve to illustrate.

or steel (e.g., Figg. 9–11.1–2). Iron handles of this type also occur but are exceptional.³² In some cases the handle assumes a trapezoidal form (Fig. 12, far left). The type is common at Herculaneum and Pompeii and, therefore, was created prior to 79 CE. How long before is hard to say. Künzl has argued for the time of Augustus, citing the earliest recovered example, a specimen from Augsburg-Oberhausen (16/17 CE).³³

The leaf-like dissector, which usually features a median ridge, may vary from narrow to rotund and compact, and have its apex pointed or rounded.³⁴ At the other end of the handle one finds a slot to receive the blade; by the 3rd century CE we occasionally find that the tang of a blade may be pegged into a tubular socket, after the manner of surgical needles.³⁵ In the case of slotted models, the slot, seen from the side, can be straight, angled like a wedge, or shaped like a keyhole. Many slots are flanked by rolled terminals. The idea that these terminals served to anchor the blade in the slot with wire passed through them has not been accepted.³⁶ It is now clear that the blade was soldered or luted into the slot. This means that the rolled terminals were, like the volutes they resemble, strictly decorative, after the manner of certain forceps types.³⁷ Thus, as a blade wore out or was broken, it could be replaced. But it was not possible to change to a different blade on the spot. The services of a smith (*faber*) were most likely required to remove an old blade and insert a new one.³⁸ In one well-known instance in Naples we find only the rectangular handle and dissector, a baluster shaped finial replacing the blade (Fig. 2, top row 11th from rt.).³⁹

32 Künzl (2002b) 28 (B1–2) may serve as examples.

33 Künzl (1991b) 194(11) and (1996) 2584–2585(6).

34 A leaf shaped grip found in the Bingen instrumentarium is surmounted by what looks like a *puren*, the olivary enlargement so common on probes; Künzl (1983a) 82(56.16.). For more on this piece and Paul 6.8.1, see further on.

35 For excellent illustration of these slots, see the specimens in Künzl (2002b) Taff. 5, 15, 17, 18–20 and, especially, the unique clover leaf version on 48(C2). For tubular sockets, see Jackson (“Back to basics: surgeons’ knives in the Roman world” [forthcoming; see Bibliography]).

36 Milne (1907) 24–25 following Heister: opposed by Jackson (1986) 133. In some cases, the original blade’s tang was stuck so fast that a new slot had to be created for its replacement; see Künzl (2002b) 44(C2).

37 Künzl (1983a) 64(34.14 Rheims); cf. Fig. 2 middle row 6th from left = Bliquez, Jackson (1994) 172(246).

38 For recent views on the relationship of slot and blade see Jackson (1986) 133; Krug (1993); and Jackson (Back to basics, [forthcoming; see Bibliography]).

39 We may have here a composite, that is, the common rectangular handle and dissector combined with a handle resembling a chess piece put together in modern times (see below). If so, this ‘centaur’ would have been created before 1822 when it was first registered

Other handle décor may include attractive damascening in silver, copper or niello.⁴⁰ The handle of a specimen recovered at Xanten is round and sports gold banding, a refinement mentioned by Lucian.⁴¹

In the Naples Museum alone there are ca. 60 specimens of this particular class and there are many more examples in museum collections.

A second type of frequently occurring handle is octagonal (rarely hexagonal) in section with a simple straight slot to receive its blade (Fig. 3, middle of bottom row; Fig. 11, 3–7; Fig. 12 far rt; Fig. 29.19–21). This model likewise usually mounts a narrow leaf shaped dissector. It is tempting to connect these slender handles with more delicate procedures (see below, Suture Knife).

Scalpel handles featuring the leaf shaped dissector are often found in quantity in instrumentaria. As many as thirteen are recorded for the grave of the Bingen Surgeon with eleven documented for the Casa del Medico Nuovo (II) in Pompeii. These numbers will surely be exceeded when final publication of the find in the Domus ‘del chirurgo’ in Rimini appears.⁴²

As they absolutely predominate among recovered specimens, I take the handle-dissector combinations just described to be the type referred to as ‘common’ (κοινόν) by Aëtius (16.23.42), and termed ‘simple’ (ἀπλὴ σμίλη) by Paul (6.41.2).⁴³

In addition to these ‘common’ handle types we find a variety of others. Some are rounded in section with multi-faceting or ring and baluster arrangements.⁴⁴ Others are shaped like fluted pilasters (Fig. 14) or specimens resembling in a general way chess pieces (Fig. 2, top row 5th from rt.).⁴⁵ These features, in addition to enhancing appearance, may also have promoted a firmer grip. In an interesting departure perhaps as many as seven handles assume the form of the bust of Hercules (Fig. 2, top row, 6th, 7th, & 9th from rt.; Fig. 13). These are

in the Naples inventories: see Bliquez, Jackson (1994) 118(39). Certainly, this type of tinkering would not have been unusual in the Naples of the 19th century.

40 Künzl (2002b) Taf. 17(B3–4) = Fig. 15.

41 Künzl (1986a) 493 and, for a color photo, Künzl (2002a) 22 (Abb. 57); Lucian, *Ind.* 29 (σμίλας χρυσοκολλήτους).

42 For a preliminary report see Jackson (2009b) 78, 87–88, where 40 handles of the octagonal and rectangular types are reported.

43 It is rare to find a set without the standard type: for the find at Kallion see Künzl (1983a) 42(11).

44 For faceting see Heres (1992) 162(3) = Fig. 83; for ring and baluster see Künzl (2002b) Taf. 48(C3) and Fig. 52.9.

45 For another pilaster type, see Künzl (2002b) Taf. 17(B1); for more nicely turned “chess-piece” types, see Bliquez, Jackson (1994) 120–121(44–51), 216(43–50).

of particular interest, as figural representation is rare on surgical instruments. The majority of the Hercules type was recovered at Pompeii, but one specimen, hailing from Corinth, is said to have been found in a 10th to 12th century context. If true, this gives an idea how long such handles might be in service.⁴⁶ The myths of Hercules entail labor and suffering; thus, his image and accoutrements are appropriate décor on scalpels and other tools associated with pain.⁴⁷ Many of the chess and Hercules type are mounted on rectangular bases with simple straight blade slots; the bases are often incised with an X-design or, with the addition of another stroke, a six-pointed star (Fig. 2, top row, 6th, 7th and 9th from rt.; Fig. 13).⁴⁸

In a few cases, a scalpel combines a blade with another instrument replacing the common dissector. Examples include a curette and two forceps from Italy (Fig. 3, bottom row below forceps, middle row, 8th and 9th from rt.), two surgical needles from Rheims (Fig. 32, middle) and two probes with olivary enlargements from Rimini (Fig. 11.5).⁴⁹

The blades inserted into these handles were in the main of iron or steel. Few surviving handles still have their blades intact, although most still have traces of rust in the blade slot attesting to their erstwhile presence. Of surviving blades, the most common is the robust convex type called 'belly-like.' Fortunately, the recently excavated Domus 'del chirurgo' has provided a number of previously unseen blade shapes. These can in some cases be matched to texts describing and naming them and/or the knives of which they form one element (see below).

This brings us to nomenclature. The standard Greek names used by authors of the Roman Empire to designate the scalpel are *σμίλη*/*smile* and its

46 Of the Hercules type, the four from Pompeii are in the Naples Museum, with word of another as yet unpublished specimen recovered in Pompeii in the Casa dei Quattro Stili; Bliquez, Jackson (1994) 119–20(40–43) and 96. For the specimen from Corinth see Davidson (1952) no. 1406, where it is not recognized for what it is. I was, some years ago, informed per litteras by Mr. A. Levi of Jerusalem that he had such a handle in his possession.

47 Bliquez (1992). Other instruments reflecting Hercules include retractors and cataract needles; see Fig. 20, 1st and 5th from left and Fig. 37.

48 Against the argument that these handles might have mounted razors is Fig. 2 top row, the 19th century photo by Alinari, which shows standard surgical blades still preserved on at least one 'chess' type as well as on the Hercules types positioned next to it.

49 Jackson (1986) 122–123 nos. 6, 10 and 11; Jackson (2003) 317; Künzl (1983a) 66 (37.37 & 38).

diminutives *σμῖλιον*/*smilion* and (rarely) *σμῖλᾶριον*/*smilarion*.⁵⁰ In contrast, *smile*, as we have seen, occurs only once in the preserved *Hippocratic Corpus* (*Diseases* 2.36P), the preferred term there being simply ‘knife’: *μάχαιρα*/*machaira*, its diminutive *μαχαίριον*/*machairion*, and even *μαχαίρις*/*machairis* and its diminutive *μαχαίριδιον*/*machairidion*. It seems then that, as surgery and the equipment it employed became more complicated, technical terms were required and *smile* and its diminutives became standard for the scalpel. The contrast is well illustrated in Oribasius where drugs are gathered/processed with the *machairion* (e.g. *Coll. Med.* 12. pi.14) but operations are performed with the *smile*. On the other hand *machaira*/*machairion* never disappeared from the surgical lexicon. It still occurs as a general designation for surgical knife (e.g. Galen, *Blood in the Arteries* 4.716K: *τι τῶν ἱατρικῶν μαχαίριων τῶν ἰσχυῶν*), in compounds like *skolopomachairion* (see below), in descriptions of special scalpels such as the lithotomy knife (see below), in Galen’s long knife for dissection (*προμήκης μαχαίριον*: *Anat. Proc.* 2.682K = 11.521Gar), and in veterinary treatises (e.g. *Hippiat. Ber.* 20.6.4). No surprise then that *machaira*/*-ion*, along with *smile*/*-ion*/*-arion* make their way into medieval texts and *Lists*.⁵¹ The Hippocratic names *σίδηρος*/*sideros* and *σιδήριον*/*siderion* in the sense of knife also very occasionally appear in Imperial literature and Byzantine sources.⁵² Latin writers, in addition to *ferrum* and (rarely) *ferramentum*, use *scalpellus*, the diminutive of *scalper*, meaning ‘cutter, incisor’; thus, the modern name in English and other languages.

The diminutive forms are very popular, indicating that, in comparison with knives used for many every day purposes, scalpels were generally seen as small. This corresponds with the size of surviving handles, including those with blades intact. Of completely intact scalpels in the Naples Museum, the largest measures 17 cm in length; several such specimens in the Bingen instrumentar-

50 That there is likely no necessary differentiation of size among these terms is shown by Paul who uses *σμῖλη* and *σμῖλιον* indifferently in several passages (6.62.2 & 6.77.2). There was also a drug called *smilion*: Paul 3.23.13.18; 4.18.6; 7.17.12.

51 Schoene (1903) 282; Bliquez (1984) 200; Fischer (1987) 32(22).

52 Galen, *Cmpds. by Kind* 13.866K: *ἐπεὶ δὲ οὐχ οἶόν τέ ἐστι τὸ ἥδη λεπρώδες ἰαθῆναι, δεύτερος ἂν εἴη σκοπὸς, ὅσπερ ἐπὶ πάντων τῶν ἀνιάτων ἐστὶ κοινὸς, ἐκκόψαι τοῦ σώματος τὸ ἀνιάτον. ἐκκόπτεται δὲ ποτὲ μὲν σιδήρῳ, ποτὲ δὲ πυρὶ, ποτὲ δὲ φαρμάκῳ ἥτοι καυστικοῖς ἢ διαφορητικοῖς τε ἅμα καὶ ῥυπτικοῖς, ὁποῖόν ἐστι τὸ προκείμενον νῦν.* Cf. also Oribasius, *Coll. Med.* 4.4.1 (harvesting a type of cabbage); Aëtius 7.45.25 = Hirschberg, Waugh pp. 70–71. Chp. 45 (trachoma, etc.); Paul 4.18.4.2 (abscess), 6.25.2 (blade of polyp knife), 6.62.4 (*hydrocele*); Alexander of Aphrodisias, *Prob.* 1.99.9 (reshaping round ulcers). See Bliquez (1984) 202 and G. Dagron (1978) 316, 352 for Byzantines.

ium are of similar size.⁵³ A handle in Mainz 16.8 cm in length without its blade would, if intact, represent the lengthiest models.⁵⁴

That the *smile/smilion* was not (as opposed to the cupping vessel) employed solely as a surgical instrument is clearly shown by Galen and Lucian who also connect it with shoemakers.⁵⁵ Their testimonia coincide with a number of specimens recovered in non-surgical contexts in Pompeii.⁵⁶

The terms λαβή/*labe* (e.g. Aëtius 15.5.63, 15.8.17; Oribasius, *Coll. Med.* 45.2.6, 45.6.2), and its diminutive λαβίδιον/*labidion* (Aëtius 6.1.53) were used to designate both handle and dissector, Galen in one instance (if the text is right) calling the dissector alone κυαθίσκος/*kuathiskos* (*Cmpds. by Place* 12.709K)⁵⁷ and in another λαβίς/*labis* (*Anat. Proc.* 2.704K = 11.547Gar).⁵⁸ Celsus, writing in Latin, uses *manubriolum* (e.g. 7.6.4; 7.22.2), a name he links only with *scalpellus*. Galen once speaks of a 'rounded' dissector, which may only reflect a squattier version of the usual leaf shape; otherwise descriptive language for this feature is non-existent.⁵⁹ The dissector is associated in the literature with conditions ranging from eye surgery to operations for hernia (see summary below). It could be sharp enough to lance or cut, as in Aëtius: 6.1.53 (lancing hydrocephaly).

Though ἔλασμα (*elasma*) may serve as a general name for blade (e.g. Oribasius, *Coll. Med.* 44.11.4, perhaps Galen, *Anat. Proc.* 2.574K = 11.389Gar, should one prefer K), the blade itself was usually identified by the names for

53 Bliquez, Jackson (1994) 116(28); Como (1925) 155 (Abb. 2 nos. 2–4, 16.0–16.5 cm).

54 Künzl (2002b) 27 (A63).

55 Lucian, *Cat.* 15.5, 20.17, and *Gall.* 26.5; Galen, *Thrasybulus, Is Health Med. or Gymn.*? 5.890K; hence the occasional qualifier, as in Plutarch, *How to Tell a Flatterer* = *Mor.* 60B, ἱατρικῶ σμιλίῳ. See also Galen *Hippocratic Glossary* 19.120.10K. I am unsure what to make of a fine single specimen found in a child's grave at Worms. For that see Künzl (1983a) 78–79(53).

56 See Bliquez, Jackson 1994 118(38).

57 The topic here is scraping eyelids indurated by trachoma. Galen could mean the scoop of, e.g., a polyp knife and not the usual dissector; alternatively the text may originally have read αὐτῷ τῷ κυαθίσκῳ τῆς μήλης and not τῆς σμίλης. In that case he was referring to the bowl of a spoon probe; see under Probes (Including Spatulas and Spoons). A spoon probe may be what lies behind Celsus 6.6.27A, where the scraping is performed *specillo asperato* as well as *scalpello*.

58 The term 'head' (κεφαλή) appears to designate the dissector/handle in three passages of the veterinary collection *Hippiatrica* where cauterization is performed μετὰ κεφαλῆς σμιλαρίου for hip dislocation, epilepsy, and cough respectively (*Ex. Lugd.* 35.3, 49.6 & 86.9).

59 See Galen (*Anat. Proc.* 2.704K = 11.547Gar): σμίλην, ἔχουσιν λαβίδα στρογγύλην. It is not out of the question that he is referring to another kind of handle here.

scalpel. Here we find ample descriptive terminology.⁶⁰ Not surprisingly we are told that a blade could be sharp (ὀξεῖα σμίλη κατὰ τὸ μῆκος Galen, *Anat. Proc.* 2.251K = 1.41Gar) or dull (σμίλη ἀμβλεία Galen, *Anat. Proc.* 2.247K = 1.35Gar), quite sharp or quite dull (ἢ ὀξύτερα σμίλη καθάπερ ἢ ἀμβλυτέρα Galen, *Anat. Proc.* 2.244K = 1.33Gar), and extremely sharp (ὀξυτάτη *Anat. Proc.* 2.673K = 11.509 Gar);⁶¹ in addition, we hear that it could be sturdy (ἰσχυρὰ σμίλη Galen, *Anat. Proc.* 2.314K = 1.105Gar), sharp and sturdy (ὀξεῖα τε ἄμα καὶ ἰσχυρὰ σμίλη Galen, *Anat. Proc.* 2.607K = 11.429 Gar),⁶² big and sturdy (ἰσχυρὰ καὶ μεγάλη σμίλη Galen, *Anat. Proc.* 2.585K = 11.401Gar), extremely heavy/sturdy (διὰ σμιλίου βαρυτάτου Oribasius, *Coll. Med.* 44.8.9), double edged (ἀμφιήκη μαχαίρια Galen, *Meth. Healing* 10.415K = J-H 2.162–163, δίγωνος Aëtius 7.90.12 = Hirschberg, Waugh p. 128. Chp. 90 line 19 who read τρίγωνος; and, as to its shape, narrow (σμιλίῳ στενῷ Aëtius 7.82.4 = Hirschberg, Waugh p. 119. Chp. 82 line 18, ἱατρικῶν μαχαίριων τῶν ἰσχνῶν Galen, *Blood in the Arteries* 4.716), longish and narrow (τῷ ὑπομήκει στενῷ σμιλίῳ Aëtius 16.108.41), pointed (σμιλίῳ ἐπάκμῳ Aëtius 4.3.3), shaped like a myrtle leaf (διὰ μυρσίνης σμιλῆς Galen, *Meth. Healing* 10.101K = J-H 3.522–523, σιδηρῇ μυρσίνῃ Pseudo-Galen, *Intro. or Physician* 14.786K = Petit 19.11); double edged and shaped like a myrtle leaf (ἀμφικύρτῳ μυρσίνῃ Galen *Anat. Proc.* 2.686K = 11.525 Gar), forged so as to be concave on one side and convex on the other (Galen *Anat. Proc.* 2.673K = 11.509 Gar),⁶³ and, finally, ‘belly-like’, a term Galen applied to the Hippocratic term ‘breast-like.’⁶⁴ The belly-like blade (now referred to also as shaped like a ‘D’) is the one most frequently found on surviving specimens, as noted above.

At times the dull side of the blade seems to be applied. At least this appears to be Oribasius’ meaning when he scrapes away rhagades, calloused cracks that have developed on the foreskin, ὑπτίῳ τῷ σμιλίῳ (*Coll. Med.* 50.10.3).⁶⁵ So

- 60 That the term *smile* basically means blade is shown by references in Oribasius to the blade of the chisel (*Coll. Med.* 44.8.7–9: τῇ τοῦ σμιλίου τοῦ ἐκκοπέως ἀκμῇ... διὰ σμιλίου βαρυτάτου ἢ κατ’ ἐνέρεσιν ἀκμῇ σμιλίου τοῦ ἐκκοπέως).
- 61 Influenced by these modifiers, the term ὀξεῖα, in the sense of scalpel, occurs among the surgical tools on *Lists*: Schoene (1903) 282; Bliquez (1984) 201.
- 62 Galen associates this type with veterinary work as well as with his anatomical explorations: ἔχουσι δὲ καὶ οἱ τῶν ἵππων ἱατροὶ τοιαύτας σμιλας.
- 63 χρῆσθαι δ’ αὐτῆς μάλιστα τῷ κυρτῷ μέρει κεχαλκευμένης (sc. σμιλῆς) <οὐχ> ὁμοίως ἐκατέρωθεν, ὥστε ἀμφικύρτους ἔχειν ἀμφοτέρως τὰς τεμνοῦσας γραμμάς, ἀλλὰ κατὰ μὲν τὴν ἐτέραν σιμῆς, κατὰ δὲ τὴν ἀντικειμένην ταύτη κυρτῆς.
- 64 *Hippocratic Glossary* 19.120K: μαχαίριδι στηθοειδεῖ· τῷ σμιλίῳ ἱατρικῷ γαστροῦδει.
- 65 ὅταν δὲ χρόνιαι οὐσαι ἐντετυλωμέναι βραδύνωσι, συμφέρει τὸ δέρμα ἀπάγειν καὶ <τὰ> τετυλωμένα τῶν ῥαγάδων χεῖλη ὑπτίῳ τῷ σμιλίῳ ὥσανεὶ ἀπογλύψαι... See also Aëtius (14.14)

too Celsus, after he cuts abrasions with the *scalpellus* to prevent suppuration, wipes off blood *eodem adverso* (7.1.1).

In a few cases *smilion* combined with a modifier designates a particular knife for a particular operation(s): viz. ἀναραφικὸν σμιλίον, ὀξυκορακὸν σμιλίον. These will be treated in the special sections given over to them below.

The point of the blade is variously called ἡ ἀκμή (Aëtius 15.5.66; Paul 6.54.1) or ἡ κορυφή (Galen, *Anat. Proc.* 2.683K = 11.521Gar) and, in Latin, *mucro* (Celsus 7.5.1; 7.15.1).⁶⁶ Paul (6.8.1.16) once writes πυρῆνι τῆς σμίλης, a term usually applied to the olivary enlargement found on probes (see under Probes). As the subject in Paul is a delicate incision of the inner eyelid, a device shaped like an olive pit hardly seems appropriate for this purpose; so Paul may be using very loose language here.⁶⁷ But scalpels with a *puren* opposite the blade survive if very occasionally.⁶⁸ *Gramme*/γραμμή (Galen, *Anat. Proc.* 2.673K = 11.509Gar), and *pleura*/πλευρά (Galen, *Anat. Proc.* 2.682K = 11.521Gar) designate the scalpel's edge; *akme*/ἀκμή (Oribasius, *Coll. Med.* 45.6.2; Paul 6.58.1) and *mucro* (Celsus 7.19.6) may also be used in this sense.

Recovered blades include these types: breast or bellied, straight, spatulate, angled, convex, and concave or hooked (See especially Fig. 11.1–7).⁶⁹ Sizes vary, with some examples especially suited to eye surgery being quite small (see below, Suture Knife).

who attributes the operation to Leonides. For Aëtius 14 I have available only Cornarius' Latin translation in which Oribasius' ὑπτίῳ τῷ σμιλίῳ is rendered *supino scalpro*.

66 See also Galen, *Meth. Healing* 10.415K = J-H 2.162–163 (τὰ δ' ἀμφήκη τῶν μαχαίρων, ἡ κατὰ τὸ πέρας ὀξέα παντὶ τρόπῳ φευκτέα). The veterinary *Mulomedicina Chironis* uses *acumen* to refer to the point of the knife, if not to the blade itself: struma is to be cut out *sagitta* (here = lancet?) *vel scalpello crassi acuminis* (549) and nasal polyp *ferramento pleni acuminis* (551).

67 It is tempting to think Paul wrote πυρῆνι τῆς μήλης as the phrase is so common; but that too does not fit the context. The text may be corrupt.

68 Jackson (2003) 317; Künzl (1983a) 65(36.31). A leaf shaped grip found in the Bingen instrumentarium (Künzl 1983a 82 (56.16) = Como 1925 156–157 Abb. 2.16) is surmounted by what looks like a *puren*. But the 'dissector', if that is what it is, is unusual in being quite flat and not followed by the usual rectangular handle equipped with rolled terminals. It is not clear whether it mounted a blade or a needle.

69 See Bliquez, Jackson (1994) Pl. xiv, top row for bellied, straight and leaf-shaped forms, Jackson (2003) 315–317, and testimony for spatulate, angled, convex, and concave or hooked forms in Rimini ("Back to basics: surgeons' knives in the Roman world" [forthcoming; see Bibliography]), and Künzl (1983a) 82(56.7) for the hooked crow or raven type at Bingen and for fine blades from Wehringen 120(96.3–4 & 6).

Passages from Celsus and Oribasius illustrate the joint application of handle-dissector and blade.

Celsus 7.19.6–7 (repairing scrotal hernia): But the scalpel at first should be held in a very light hand with its edge vertical to the skin until the wall of the scrotum has been divided; then the edge (*mucro*) is sloped sideways so as to cut across the membranes between the scrotal wall and the middle tunic... Now wherever the disease is found to be, the assistant should press the scrotum gently upwards; the surgeon either with his finger or with the handle of the scalpel (*manubriolove scalpelli*), separates the middle tunic from its connexion with the scrotal wall, and brings it forwards; then with a knife called the ‘raven’ (*coruom*) he lays it open so that his index and middle finger can enter (Spencer’s translation).⁷⁰

Oribasius, *Coll. Med.* 45.6.2 (removing poros, a stony growth): When the poros is small, let the overlying tissue be cut with a straight/simple incision. But when it is large, let the incision to remove it be in the form of a myrtle leaf. When the poros has been exposed, let the edges of the incision be separated with sharp retractors; then let the underlying mass be removed with either the handle of the scalpel (τῇ τοῦ σμιλίου λαβῇ) or the bend of a bone lever or stone extractor. When a callous has formed over the depressed area, let it be bloodied with the edge of the scalpel blade (ἀκμῇ)...⁷¹

I now list most of the sources attesting operations where the scalpel is explicitly mentioned. It is impractical to cite the many cases in which the scalpel is not named but surely lies behind the various expressions used for cutting.

References are arranged under the term for the scalpel used. The reader will note that in many cases an intervention is described under more than one scalpel term.

70 *Sed primo rectus scalpellus quam leuissima manu teneri debet, donec scrotum ipsum diducat; tum inclinandus mucro est, ut transuersa membrana secet, quae infra summam mediamque tunicam sunt... Vbi cumque autem repertum est malum, ministrum ab inferiore parte exprimere moderate scrotum oportet; medicum digito manubriolou<e> scalpelli deductam inferior<e> <parte> tunicam extra conlocare; deinde eam ferramento, quod a similitudine coruom uocant, incidere sic, ut intrare duo digiti, index et medius, possint.*

71 μικροῦ μὲν οὖν ὄντος τοῦ πώρου, ἀπλοτομείσθω τὸ ἐπικείμενον αὐτῷ σῶμα· μεγάλου δέ, μυρσινοειδῶς ἐκτεμνέσθω, καὶ γυμνωθέντος αὐτοῦ τὰ χεῖλη τῆς τομῆς ἀγκίστροις διαστελλέσθω· ἔπειθ’ ὁ ὑποκείμενος ὄγκος τῇ τοῦ σμιλίου λαβῇ ἢ ἀναβολέως ἢ λιθοῦλκου καμπῇ κομιζέσθω, καὶ τετυλωμένου τοῦ βάθους τῇ τοῦ σμιλίου ἀκμῇ αἵμαστέσθω...

σμίλη/*smile*

Alexander of Tralles: bleeding for pleurisy (*Therap.* 2.233.2).

Galen:⁷² lancing pustules/blisters on legs (*Sects for Beginners* 1.91K); pressuring the chiton of the bladder with *labis/labe* (*Anat. Proc.* 2.704K = 11.547Gar); excising scrofulous swellings/choirades (*Meth. Healing* 10.983K = J-H 3.482–483); lancing abscess (*Meth. Healing* 10.984K = J-H 3.482–483), restoring deficient foreskin (*Meth. Healing* 10.1002K = J-H 3.508–509); excising oral wart/myrmekia (*Meth. Healing* 10.1011K = J-H 3.522–523); scarification/scraping alopecia (*Cmpds. by Place* 12.413K [Asclepiades]); curating roughness of eyelid in trachoma with *kuathiskos* (*Cmpds. by Place* 12.709K); lancing abscess (*Comm. Hipp. Epid.* 6, 17a.958K = Wenkebach p. 94); surgery on heel (*Comm. Hipp. Fractures* 18b.450K).

Pseudo-Galen: adhering eyelids/symphysis (*Intro. or Physician* 14.785K = Petit 19.9).

Oribasius: scrofulous swellings/choirades (*Coll. Med.* 45.21.2); treating injury to heel (*Coll. Med.* 47.9.3); removing thymi on glans penis (*Coll. Med.* 50.8.2).

Paul of Aegina: incision of eyelid for trichiasis with *πυρήν τῆς σμῖλης* (6.8.1); removing ganglion (6.39.1); cupping (6.41.2); amputation of preternatural fingers (6.43.1); restoring deficient foreskin (6.53.1, [Antyllus]); correcting hydrocele (6.62.2); correcting enterocele (6.65.2); reduction of pendulous scrotum (6.67.1 [Leonides, Antyllus]); castration (6.68.1); clitorrectomy (6.70.1); fistula (6.77.2); excising piles (6.79.1 [Leonides]); anal fissures (6.80.1); excision of varicose veins (6.82.1); evacuating blood under bruised nail (6.86.1 [Galen]); excising myrmecia (6.87.1); accessing fractured clavicle (6.93.3); accessing distorted union (6.109.1).

σμίλον/*smilion*

Aëtius: 4.3.3 (severing umbilical cord); 6.24.37 (enlarging dog bite); 7.64.3 (encanthis) = Hirschberg, Waugh pp. 98–99. Chp. 64; 7.71.42 (incision of eyelid for

72 N.B. Galen cites the *smile* around 50 times in connection with dissection, mostly in *Anatomical Procedures*, his extensive manual on the subject (2.215–731K). Since surgery on humans is not directly at issue in these passages, I do not include them here. References in *Anatomical Procedures* to particular types/shapes, because they may lie behind simple references to the *smile* in surgical treatises, have been treated in the discussion of types/shapes above. I have also not included the few references in the Galenic Corpus to uses of the *smile* not strictly defined. The same process of selection has been followed in the rest of this list of sources.

trichiasis w/ suture knife [Leonides]) = Hirschberg, Waugh pp. 106–107. Chp. 71; 7.74.2 (ektropion [Antyllus]) = Hirschberg, Waugh pp. 108–109. Chp. 74; 7.82.4 (lithiasis) = Hirschberg, Waugh pp. 118–119. Chp. 82; 7.83.4 (chalazion) = Hirschberg, Waugh pp. 120–121. Chp. 83; 7.90.12 (rhyas) = Hirschberg, Waugh pp. 128–129. Chp. 90, who read *σμῖλις* *τριγώνω*; 7.95.11 (angiologia in wake of rhyas); 15.5.63 & 66 (dissecting out choiras/scrofulous swellings w/ *labe*); 14.14, Cornarius (scraping crack/chap on penis); 15.8.17 (dissecting out steatoma w/ *labe*); 15.18.1 (apostema/abcess); 16.23.42 & 59 (opening head of impacted embryo); 16.100.4 (fistula twist gut and peritoneum); 16.108.41 (imperforate womb); 16.117.35 (uterine thymi, myrmekia and acrochordon).

[Dioscorides], *Euporista or Simples* 1.44.2 (scraping calloused eyelids).

Galen: treating poisonous wounds and bites (*Antidotes* 14.200K).⁷³

Oribasius: bloodletting (*Coll. Med.* 7.20.4); excision of ribs (*Coll. Med.* 44.8.9); scraping callous of fistula (*Coll. Med.* 44.20.4 [Antyllus, Heliodorus]); dissecting steatoma with *labe* (*Coll. Med.* 45.2.6 [Antyllus]); removing poros with *labe* (*Coll. Med.* 45.6.2 & 6); dissecting choiras/scrofulous swellings with *labe* (*Coll. Med.* 45.17.6); breaking off fragments of skull fracture (*Coll. Med.* 46.11.28); to remove hypersarkosis (*Coll. Med.* 46.25.2); amputation of extremities (*Coll. Med.* 47.14.6 [Heliodorus]); to correct imperforate glans penis (*Coll. Med.* 50.3.6 [Antyllus, Heliodorus]); freeing adhesion of foreskin (*Coll. Med.* 50.6.2); scraping crack/chap on penis (*Coll. Med.* 50.10.3); severing umbilical cord (*Coll. Med., Lib. Inc.* 29.1 [Galen]); scraping callous of fistula (*Ecl. Med.* 100.4); removing wart/corn on foot (*Ecl. Med.* 113.2).

Paul of Aegina: to remove wart/corn (3.80.1); incision of eyelid for trichiasis with suture knife (6.8.1); to correct ectropion (6.12.1); to access chalazion (6.16.1); to excise acrochordon (6.17.1); to excise pterigium (6.18.1 with suture knife); for uvulectomy w/ suture knife (6.31.2 for suture kn. see below); to repair umbilical hernia (6.51.2); to correct imperforate glans penis (6.54.1); to separate prepuce adhering to glans (6.56.1); to remove thymi on glans penis (6.58.1); to repair hydrocele (6.62.2); to repair cirsocele (6.64.2); to open anal fistula (6.78.2); to excise pterygia about the nails (6.85.2); to remove wart/corn w/ crow (6.87.1 for crow/raven knife see s.v. below).

73 So too Aëtius 13.25 but it is uncertain whether *smile*, *smilion* or *smilarion* lies behind the *scalpellus* of Cornarius' Latin translation.

Soranus: cutting umbilical cord (*Gyn.* 2.11.2 Ilberg = 2.6.15 BGM); opposes lancing gums with *smilion* (*Gyn.* 2.49.5 Ilberg = 2.18.21–23 BGM).

σμιλάριον/*smilarton*

Aëtius: lancing hydrocephaly with *labidion* (6.1.53); excising epulis with narrow *sm.* (8.27.16); lancing inflamed tonsils 8.48.70 [Philumenus]].

Pseudo-Galen: excising nasal polyp with narrow *sm.* (*Intro. or Physician* 14.785K = Petit 19.10); repairing mutilated lips (*Intro. or Physician* 14.791K = Petit 19.16).

These terms (as well as many others for surgical instruments) are also commonly found in the 9th century collection of veterinary treatises called *Hippiatrica*. This indicates that the tools used on animals differed but little, if at all, from those used on humans.⁷⁴

Scalpellus

Celsus: blood letting (2.11.3–5Ser); relieving humor in the head (4.2.9); incising to reach abscess of liver (4.15.4); laying open a bruise (5.26.23G); treating an old wound (5.26.32); cutting scar for cosmetic correction (5.26.36C); extracting venom from snakebite (5.27.3B); treating carcinoma (5.28.2C–E); scarifying bald patches (6.4.3); excising sclerotic portion of eyeball in proptosis (6.6.9C); scraping eyelids indurated by trachoma with fig leaf, scalpel or *specillo asperato* (6.6.27); notching of foreskin in *phimosis* (6.18.2B); excising penile gangrene (6.18.3B); scraping whitlow on finger (6.19.3); incising abrasions to prevent suppuration and wiping off blood *eodem adverso* (7.1.1); incising abscess when cautery cannot be used because of proximate sinews (7.2.4–5); dividing anal fistula (7.4.4C–D); creating counter opening or enlarging wound for extraction of missile (7.5.1A–C); removing steatoma,

74 *Smile*: *Ber.* 11.39.9 (removing pterygium); *Ber.* 18.2.3 (opening inflamed boils/swellings around ears); *Ber.* 26.9.8 & 18.8 (chronic sore shoulder); *Ber.* 117.6.2 (strain/dislocation); *Paris.* 116.4 (opening inflamed boils/swellings around ears); *Cantabrig.* 41.4.10 (opening a varix). *Smilion*: *Ber.* 20.2.5 & 7.9 (choirias); *Ber.* 69.26.8 (psora); *Ber.* 75.12.5 (bleeding for cholera); *Ber.* 87.6.9 (peeling epidermis in mouse bite); *Cantabrig.* 67.3 (excising myrmekia); *Frag. Anat. de Eq.* 21.10 & *Frag. Anat. de Bub.* 23.1 (foot repair for lameness). *Ber.* 117.6 (hoof); both *Cantabrig.* 65.4 (removing thorns) and *Cantabrig.* 100.2–4 (opening fistula, have *smile* and *smilion* deployed indifferently in the same surgery. *Smilarton*: *Ber.* 11.33.3 (ophthalmia).

including use of *manubriolum* (7.6.4); incising to free eyelid cyst (7.7.1B); incising small eyelid tumor called crithe (7.7.2); removing chalazion, including use of *manubriolum* (7.7.3); detaching and excising pterygium from eye, including use of *manubriolum* (7.7.4B–C); separation of eyelid adhering to white (7.7.6B [Heracleides of Tarentum]); plastic operation for trichiasis (7.7.8F); incising blood vessels of head for relief of rheum in eyes (7.7.15F.); to open occluded auditory canal (7.8.2); to eliminate holes for ear rings (7.8.4); to excise tonsil (7.12.2); incising to reach goiter/bronchocele (7.13.2); incising to expose abdominal rupture (7.17.1B); repairing inguinal/scrotal hernias, including use of *manubriolum* (7.19.1–8–7.20.1–6); separating varix with *manubriolum* before excision in cases of varicocele (7.22.2); to reverse circumcision (7.25.1C); to remove bladder stone (7.26.2N, plus fr. 2 of Toledo supplement to Celsus 4.27.1D); to excise anal fissures (7.30.1); to excise hemorrhoids (7.30.3); to expose varicose veins (7.31.2); to separate adhering fingers (7.32.1); to amputate (7.33.1); to scrape away diseased cartilage and bone (8.2.2).

Cicero: to correct ankyloglossia (*On Divination* 2.96).

Ferrum as Knife

Celsus: general term for scalpel (Pro. 3Ser); vivisection (Pro. 42Ser); cupping w/ scarification for hydrops/dropsy (3.21.9); incising struma (5.28.7); opening abscesses (5.28.11D; 7.2.4); excising nasal polyp (6.8.2B; 7.9.10); opening fistula (7.3.4, 7.4.4D).

Ferramentum

Celsus: excising nasal polyp, where the *ferramentum* (perhaps a lancet) should be shaped like a spear (*ferramento acuto in modum spathae*: 7.9.10); incising for dropsy (7.15.1).

We may now proceed to consider names that designated surgical knives deployed for special purposes. In many cases these look to consist merely of the handles described above combined with blades suited to a specific intervention.

Phlebotome

After the scalpel the most commonly mentioned cutting instrument is the φλεβοτόμον, transliterated in Latin authors as both *phlebotomon* and *fleboto-mon*. We once see the feminine form φλεβοτόμη in the later veterinary collection *Hippiatrica* (Ex. Lugd. 29.11).

References to the phlebotome occur regularly in Imperial and Byzantine sources including *Lists*.⁷⁵ Its very name suggests its primary purpose: bloodletting by incising a vein. As Celsus remarks, bleeding might be performed for virtually any malady (2.10.1). However, the sources assembled below show that the phlebotome was also deployed in a variety of other interventions. Among these we find exposing growths like hydatids and abscesses like lacrimal fistula, lancing hydrocele, incising and scraping in cases of phimosis, dissecting parulis, and even use of the phlebotome as a unit of measure (Paul 6.8.3 ὅσον στενοῦ φλεβοτόμου).

While a lancet-like tool might underlie some references to the *phlebotomon*,⁷⁶ its numerous citations and the different operations associated with it suggest that often no more than the common scalpel mounting various blades lies behind the term. Galen, for example, equates the Hippocratic ‘sharp knife’ with the *phlebotomon* of his own time.⁷⁷ Noteworthy too are the chapters on bloodletting and cupping in Celsus (2.10 & 11Ser) and Paul (6.40 & 41), which feature the *smile/scalpellus*, *phlebotomon* occurring only once in Paul as an alternative to *smile*, if alternative it really is (6.40.6 ἀκμῇ φλεβοτόμου ἢ σμιλίου). The case of Celsus is even more arresting: he never employs a *phlebotomon* for any purpose, the term only appearing in the much later Latin authors Caelius Aurelianus and Cassius Felix. Finally, the veterinary collection *Hippiatrica* refers to models that were not straight but broad, suggesting the bellied or breast shaped scalpel; the same source also allows that the instrument, if not a drill, was sometimes called σχαστήριον.⁷⁸ In contrast, Caelius Aurelianus in treating *synanche*, or severe sore throat, prescribes use of a “slender and lengthier phlebotome”

75 In addition to Aëtius and Paul, Byzantines include Theophilus Protospatharius, Damascius and Stephanus, *Comm. Hipp. Aph.* 2.505 (bleeding) and Leon Iatrosophistes, *Conspectus Medicinae* 2.1.4 (bleeding). For *Lists* see Schoene (1903) 283; Bliquez (1984) 203; Fischer (1987) 33(1).

76 The narrow phlebotome Paul refers to at 6.8.3 (ὅσον στενοῦ φλεβοτόμου) may very well be a lancet, as it is measured against tiny reed plates used to strangle eyelid tissue beset by trichiasis. This surely indicates Paul has in mind a tiny fine blade.

77 *Hippocratic Glossary* 19.120 & 19.133K: μαχαίριδι ὅξυβελει· τῷ φλεβοτόμῳ.

78 See *Ber.* 103.11.7 (lancing roof of mouth for headache μὴ ὀρθῶ, πλατεί δὲ τῷ φλεβοτόμῳ); 26.7.5–8 (making an opening in dislocated shoulder φλεβοτόμῳ for insertion of καλαμισκάριον, then puncturing the area σχαστηρίῳ). Other veterinary interventions, aside from general bleeding, include: *Ber.* 87.5.4 (cleaning up mouse bite ὀρθῶ φλεβοτόμῳ); *Paris.* 1082.10 (scraping/stimulating rectal prolapse); *Cantabrig.* 5.1 (bleeding for lung disease), 49.5 (bleeding for weariness and ulceration); *Ex. Lugd.* 29.11 (making opening in dislocated shoulder φλεβοτόμῳ for insertion of αὐλίσκος).

(*Acut. Diseases* 3.3.22 *tenue ac longiore phlebotomo*). This coincides with testimonia in which the phlebotome is recommended as an alternative to the pterygium knife and the *skolopion* (see below for both). These instruments likely mounted slender blades; so we may assume that was often the case with the *phlebotomon* as well, though, as Caelius' use of the comparative degree of the adjective *longiore* shows, length will have varied.

Aëtius once mentions a φλεβοτόμον ἐπικρουστικόν, which he rejects as appropriate for opening the veins of the forehead in treatment of madness (6.8.91; cf. also Galen, *Cmpds. by Place* 12.413K and ἐπικρούστιον on *Lists*).⁷⁹ This name, deriving from the verb ἐπικρούω ('to strike'), allows for the possibility that there was a type of phlebotome meant to meet or graze the target vessel at an angle. If so, this may be the Greek term for a unique bloodletting instrument found in the House of the Surgeon in Pompeii (Fig. 16). This piece, consisting of a copper alloy handle with a steel blade issuing from its upper side, clearly was operated by sweeping/striking it against the desired surface. The fact that this was probably a veterinarian's tool does not preclude its use on humans.⁸⁰

The reasons for performing phlebotomy coincide with those given above for cupping with scarification. However, phlebotomy was considered a more radical and dangerous intervention than cupping and less efficacious by Celsus (2.11.5–6Ser). Indeed we hear of patients being bled to the point of unconsciousness or even death.⁸¹

Whatever theoretical considerations were in the mind of the Greco-Roman surgeon, one cannot escape the feeling that bleeding was practiced with the frequency and the enthusiasm that it was because some sort of desired result was achieved often enough. In many cases the improvement in the condition of the patient may only have been psychological. But in others bleeding will have had a useful physical effect; if, for example, it was employed in situations where discomfort was caused by a malady that we now in fact relieve by extracting blood.⁸²

79 Schoene (1903) 282; Bliquez (1984) 199.

80 Bliquez, Munro (2007) 491–493.

81 E.g., Hippocrates, *Appendix, Reg. Ac. Diseases* 31; Galen, *Curing by Bleeding* 11.288K (copied by Oribasius, *Coll. Med.* 7.3.8 & *Syn.* 1.8.3).

82 I have personally witnessed an elderly neighbor with congestive heart failure being bled by an emergency medical team. In this case about a pint of blood was extracted by hypodermic needle.

The following references, listed by author, summarize the surgical interventions involving the *phlebotomon*.⁸³

Aëtius: bleeding the forehead for mania/madness φλεβοτόμῳ αὐτὴν διαιροῦντες οὐκ ἐπικρουστικῶ (6.8.91 [Archigenes, Posidonius]); phlebotomy (7.8.1 = Hirschberg, Waugh pp. 12–13. Chp. 8); opening a pus pocket on the white coat of the eye (7.30.41= Hirschberg, Waugh pp. 38–39. Chp. 30); accessing aegilops φλεβοτόμῳ ἢ πτερυγοτόμῳ (7.87.35 [Severus] = Hirschberg, Waugh pp. 124–125. Chp. 87); dividing parulis (8.26.8).

Caelius Aurelianus: scarifying the tongue in treating synanche *tenui ac longiore phlebotomo* (*Acut. Diseases* 3.3.22).

Cassius Felix: making a shallow incision for leprosy?/maculae albae, *acuto flebotomo* (8.2); exposing fistula, *ferro nudare . . . , id est ex flebotomo vel syringotomo appellato* (20.2).

Galen: venesection (*Anat. Proc.* 2.387K = 1.179Gar).

Pseudo-Galen: separating adhering prepuce in phimosis (*Intro. or Physician* 14.787K = Petit 19.11).

Oribasius: separating adhering prepuce in phimosis φλεβοτόμῳ ἢ σκολοπίῳ (*Coll. Med.* 50.5.4 [Antyllus]); dividing parulis (*Ecl. Med.* 17).

Paul of Aegina: dividing parulis (3.26.6. & 6.27.1); dividing temporal vessels for hemi-crania (6.5.1); exposing hydatids (6.14.1); accessing aegilops πτερυγοτόμῳ ἢ φλεβοτόμῳ (6.22.1); dividing aneurysm (6.37.2); bleeding frontal vein of forehead for headache ἀκμῇ φλεβοτόμου ἢ σμιλίου (6.40.6); separating adhering prepuce in phimosis φλεβοτόμῳ ἢ σκολοπίῳ (6.55.1); dissecting and lancing hydrocele (6.62.2); opening varicose veins (6.82.1); removing corns/clavi δξυκοράκῳ σμιλίῳ ἢ φλεβοτόμῳ (6.87.1).

Raven/Crow

As well as the bird, the term ‘raven/crow’ (κόραξ/*korax* in Greek, *corvus* in Latin) also designated anything shaped like its beak. A number of authorities refer to a type of surgical knife/blade, which either is called a *korax* or is compared

83 Frequent references to the verb φλεβοτομεῖν/*phlebotomein* (‘to let blood’) are not included.

to one. These include Celsus (7.19.7–8 *ferramento, quod a similitudine corvom uocant*), Oribasius (*Coll. Med.* 44.7.5 τῷ τοῦ σμιλαρίου κόρακι) and Paul (6.87.1 ὀξύκοράκῳ σμιλίῳ ἢ φλεβοτόμῳ). These authorities use the ‘crow’, respectively, to open the scrotum in operation for hernia, to lance an intercostal abscess, and to remove corns.

The reference in Paul links together the crow scalpel and the phlebotome; so one envisages the ‘crow’ as a gently curving pointed blade with cutting edge on one side mounted, as most phlebotomes, on the standard handle with leaf shaped dissector. Among surviving instruments a scalpel in Naples (Fig. 10) features this arrangement, as does a similar piece in Bingen and a lengthier model in Rimini (Fig. 11.4).⁸⁴ These may represent the instrument in question.

Lancet (Katias)

While it is unclear to what degree the term *phlebotomon* ever designates a spear-like lancet, i.e., a triangular blade mounted on a shaft, at least one passage in the literature allows for such. This is provided by Aëtius where we hear of a “tool, the one like a spear” (ἐργαλεῖον τὸ λογχητικόν) for dividing an imperforate hymen (16.108.24).

Equally scarce are surviving instruments shaped like a spear. The finest example is preserved in a set from Asia Minor (Ephesus?) now kept in Mainz. It features an iron blade in the form of a lance head on one end of its copper alloy shaft and an iron cautery at the other (Fig. 20, 7th from left).⁸⁵ This would appear to be the tool Aëtius had in mind.

In *Hippiatrica* (*Ber.* 26.7.8 & 9.5) we find puncturing performed with a tool called σχαστήριον, literally a ‘splitter.’ This might be a spear-like lancet; however, an ordinary scalpel/phlebotome or even a drill bit (*Ber.* 26.18.6: τρυπᾶν) cannot be excluded.

One is tempted to think that the name κατιάς/*katias* and its diminutive κατιάδιον (*katiadion*) could also be applied to the lancet in Mainz.⁸⁶ The *katias* occurs only in a few sources before we find it included on *Lists*.⁸⁷ Aretaeus

84 Bliquez, Jackson (1994) 115–6(28), Künzl (1983a) 82(56.7), Jackson (2003) 317 and (2009b) 78 and 88.

85 Künzl (1983a) 47(15.12). Two small instruments of copper alloy in Baltimore’s Welch Medical Library feature a shaft with an olivary enlargement on one side and a lancet-like head on the other. These are most likely spatulas/ligulas/probes but their use as lancets is not impossible: see Bliquez (1982) 208 (26 & 28) and Fig. 18.

86 Milne’s cites as variants καθιάς (Paul) and κατειάδιον (Aretaeus). These readings of Briau (1855) and Adams (1856), respectively, have not been retained in the more recent editions of Heiberg (1921–24) and Hude (1923).

87 Schoene (1903) 202; Bliquez (1984) 200; Fischer (1987) 34(3).

finds it useful for provoking nasal bleeding (*Care Chron. Diseases* 1.2.9, chronic headache), Soranus for slitting the chorionic membrane (4.7.8 Ilberg = 4.4.67–69 BGM), Oribasius for puncturing rectal abscess (*Coll. Med.* 44.11.4), Aëtius for lancing abscess in the throat (8.48.70), and Paul for opening uterine abscess and the head of a hydrocephalic fetus (6.73.2 and 6.74.3). Aretaeus describes it as long (κατιάδιον εὐμηκες), and Oribasius refers to the “blade of a fine/slender *katias*” (στενῆς κατιάδος ἔλασμα). These passages demonstrate that all of the operations in which the *katias* is employed involve puncturing in the orifices of the body, suggesting a spear-like form.

Unfortunately, the surgical knives that our sources allow as suitable substitutes for the *katias* in the above interventions seem incompatible with the ἐργαλεῖον τὸ λογχητικόν mentioned by Aëtius and exemplified by corresponding survivals. Oribasius, for example, would also deploy the *hemispathion* (ἀκμή ἡμισπαθίου ἢ κ.) and Paul the *spathion* (σπαθίω ἢ κ.) in their testimonia, both names suggesting a spatulate blade (see below), while Aëtius 8.48.70, or his source, contents himself with a *smilarion* (σμιλαρίω ἢ κ.). A scholiast to Oribasius further muddies the situation when he maintains that Oribasius equated the *katias* with the phlebotome and the ‘crow.’⁸⁸ It would seem then that the *katias*’ blade assumed a number of forms, some quite fine. If the latter also happened to be mounted on a shaft, they would have been particularly suitable for puncturing operations in confined places.

Aretaeus couples *katiadion* with the name στορύνη (κατιάδιον εὐμηκες ἢ τὸ καλούμενον στορύνη). The latter name occurs nowhere else and, therefore, may be an alternative term for *katiadion* (so LSJ).

Finally, there is the matter of the *oxubeles*/ὄξυβελές (ὄργανον), once used with the *smilion* by Asclepiades in his treatment of alopecia, as recorded by Galen (*Cmpds. by Place* 12.413K). One might be tempted to see a spear-like lancet behind the term because, unlike the *smilion*, which is deployed as a scraper in this account, the pointed *oxubeles* is applied as a puncturing instrument to promote modest bleeding.⁸⁹ Galen himself is the stumbling block. In his *Hippocratic Glossary* (19.120) he defines the Hippocratic *macharis oxubeles* of *Diseases* 2.47P as a phlebotome.⁹⁰ This suggests that he probably viewed

88 Schol. R2 as recorded by Raeder *ad loc.* 44.11.4: “Ὅτι κατιάδα τὸ φλεβοτόμον καλεῖ ἐν τῷ ια τῶν Χειρουργουμένων κεφαλαίῳ περὶ φλεβοτομίας καὶ τὴν ἀκμὴν τῆς κατιάδος κόρακα. The passage seen by the scholiast occurs nowhere in the preserved text of Oribasius.

89 τὸν δὲ μέσον χρόνον τῷ τε καταξυσμῷ τῷ διὰ τοῦ σμιλίου συνεχῶς ἐνεργοῦμεν καὶ ἔστιν ὅτε τῇ ακμῇ τοῦ ὄξυβελούς ἐπικρούοντες τὸν χρώτα διὰ τῶν νυγμάτων αἱμάτιον ἐκομίσάμεθα σύμμετρον.

90 μαχαίριδι ὄξυβελεῖ· τῷ φλεβοτόμῳ. Cf. also Rufus, again as recorded by the scholiast (R2) to Oribasius, *Coll. Med.* 44.11.4: ὄξυβελές καλεῖ τὸ φλεβοτόμον.

Asclpiades' *oxubeles* in the same light, that is as a pointed knife; for example, the *σμιλίον ἐπάκμον* deployed by Aëtius to sever the umbilical cord of a newborn (4.3.3).

Suture Knife

The ἀναρραφικὸν σμιλίον/*anarrhaphikon smilion* surfaces late in the written sources and only in the texts of Aëtius (7.71) and Paul (6.8.1). Its name 'suture knife' (ἀναρράπτω = 'lift by sewing') derives from the primary surgery associated with it: the repair of an eyelid afflicted with *trichiasis* consequent on granular ophthalmia. Aëtius uses Leonides as his source, as Paul must, since he describes the operation in similar language. As Leonides was active in the first or second century, the *anarrhaphikon smilion* was in service by then. According to Leonides, the suture knife was used to make two very shallow incisions enclosing the superabundant skin on the inner surface of the eyelid. The surface tissue thus outlined in the shape of a myrtle leaf was peeled away, and the lips of the incisions were then sutured together; hence the name of the knife. In addition Paul recommends use of the suture knife to excise pterygium after that growth has been raised with a sharp hook and dissected to its base with a horse's hair (6.18). He also utilizes it in uvulectomy as an alternative to the *staphulotomon* or uvula knife (see below).

The 9th century compiler Leon Iatrosophistes once mentions an 'eyelid knife' or βλεφαροτόμον/*blepharotomon*. He states that some use it to lance parulis or gum boils (*Conspectus Medicinae* 4.5.1). Surely this instrument is the same as the *anarrhaphikon smilion*. The name *blepharotomon* may also have been entered on *Lists*.⁹¹ As Leon often cites earlier sources, his testimony indicates that the name *blepharotomon* was probably another name for the suture knife in Imperial texts now lost.

Nowhere is any description given of the form the *anarrhaphikon smilion* assumed. All we can say is that the operations involved require a small fine blade with a sharp point. Blades that look suitable are preserved on several of the smaller scalpels with octagonally sectioned handles recovered from a mid third century grave at Wehringen⁹² and on three such handles recovered recently in the Domus 'del chirurgo' at Rimini (for two such see Fig. 11.6–7).⁹³

91 Schoene (1903) 282 so restored βλεβοτομον on Laurent. gr. 74.2; accepted by Bliquez (1984) 195.

92 Künzl (1983a) 120–1(95–6).

93 Jackson (2009b) 78 and 88.

Knife for Excision of Pterygium

Like the suture knife the pterygium knife or *pterygotomon* (πτερυγοτόμον) is found only in Aëtius and Paul before we see it again on *Lists*.⁹⁴ Neither author cites an earlier source; but given the practitioners they usually cite (Leonides, Antyllus, etc.), the term likely came into use well before the 6th century CE.

In addition to cutting away pterygium, Aëtius and Paul record use of the *pterygotomon* for severing eyelid adhesion and for opening the fistula in cases of aegilops inclining toward the inner canthus.⁹⁵ Otherwise Aëtius removes a growth on the white of the eye with the instrument (7.59.5 = Hirschberg, Waugh pp. 92–93. Chp. 59), while Paul dissects out growths blocking the auditory canal (6.23.8).

Nowhere is the appearance of the *pterygotomon* described but, as it was employed mainly for eye surgery, one is inclined to think it differed but little, if at all, from the suture knife; and in fact in pterygotomy Paul attests the use of both. However, in treatment of aegilops he and Aëtius deploy as alternatives the phlebotome, and Paul also uses the polyp knife (see below) to open imperforate meatus auditorius.

Paul's account of pterygotomy may get us a bit further. *Pterygium*, a growth like a wing (hence its name in Greek) extends from the inner canthus, where it is thicker, toward the pupil, where it becomes thinner.⁹⁶ Paul tells us to raise it with a sharp retractor and, using a needle, to pass a horse's hair and a linen thread through the middle of the growth. Next he directs us to raise the *pterygium* with the thread, saw it away with the horsehair and, finally, to use the suture knife to excise the part closer to the inner canthus. He then adds: "some, when they have raised it with the linen thread dissect away the entire *pterygium* with the *pterugotomon*."⁹⁷ This would seem to mean that the blade of the *pterugotomon* was perhaps finer than that of the suture knife, so as to be better

94 Schoene (1903) 283, Bliquez (1984) 202, and Fischer (1987) 34(4), the latter for corruptions of the name and maybe a variant: πτερυγοσμύλιον.

95 Pterygium (Aëtius 7.62.13 = Hirschberg, Waugh pp. 96–97. Chp. 62; Paul 6.18.1), ankylosis or adhesion of eyelids (Aëtius 7.66.9 = Hirschberg, Waugh pp. 100–101. Chp. 66; Paul 6.15.1), aegilops or fistula lachrymalis (Aëtius 7.87.35 [Severus] = Hirschberg, Waugh pp. 124–125. Chp. 87; Paul 6.22.1).

96 Typically the pterygium is thicker over the sclera at its base and much thinner as it advances onto the cornea over time. This is probably due to the underlying tissue, the sclera, which is a disordered array of collagen while the cornea is regular array. Nowadays the condition is treated using a knife; then either topical medication or radiation is applied to prevent re-growth.

97 τινές δὲ τῷ λίνῳ ἀνατείναντες, ὡς εἴρηται, πτερυγοτόμῳ τὸ ὅλον ἀποδέρουσι πτερύγιον.

suated to the thinner outward portion of a *pterygium*. Jackson offers a number of candidates from Rimini (Fig. 11.6–7).⁹⁸

By seemingly preferring the procedure with the suture knife and by indicating that only ‘some’ used the *pterygotomon*, Paul also hints that the latter was not all that widely in circulation.

Kephalike (?) Smile

Galen, citing Archigenes, is the sole source for this name. In treating aegilops/fistula lacrimalis Archigenes divides the canthus and, after drilling into the fistula with a fine drill, he then applies something called the *kephalike*, which results in bone scales being cleared away.⁹⁹ If *smile* is understood as being ellipsed after *kephalike*, then a fine knife or chisel is at issue. *LSJ* accepts *smile* and takes the term as a strong sharp chisel. However, the Latin translator of the Kühn edition renders *kephalike* as *emplastrum* or plaster and he may be right; see *Kephalike (emplastros)* of Philotas under the Appendix.

Skolopion/Skolopomachairion

In dividing the prepuce from the inner parts in cases of *phimosis*, and in opening enfleshed urethra, Antyllus and Heliodorus employ an instrument called σκόλοψ/*skolops* or σκολόπιον/*skolopion* (Oribasius, *Coll. Med.* 50.5.4 & 50.9.2; Paul 6.55.1). Paul refers to the same instrument in lancing dropsy (6.50.2). A similar name, σκολοπομαχάριον/*skolopomachairion*, is applied to a knife used in excising the growth called myrmekia (Galen, *Meth. Healing* 10.1011K = J-H 3.522–523), in dividing blood vessels in hupospathismos (Paul 6.6.1; for which operation see below: *spathion*), and in opening blocked auditory passages (Paul 6.23.1), empyema (Paul 6.44.2), the fetal membrane in embryotomy (Aëtius 16.23.21 [Philumenus]), and the head of an impacted fetus (Paul 6.74.3). In the two latter citations a polyp knife or a *katias* can be substituted.

The similar names *skolopion* and *skolopomachairion* indicate that they designate one and the same instrument.

Skolopion means ‘little stake’; so we may conclude that this knife featured a long, narrow, pointed blade designed for puncturing and fine dissecting. And in fact Heliodorus explicitly refers to its narrowness (Oribasius, *Coll. Med.* 50.9.2: σκόλοπι τῷ στενῷ). From Paul’s account of hupospathismos (6.6.1) we also learn about the blade that it was not just pointed but that it was sharp on

98 Jackson (2009b) 78 and 88.

99 *Cmpds. by Place* 12.821–2K [Archigenes]: διελὼν τὸν κανθὸν καὶ διαστήσας κατατίτρα λεπτῷ τρυπανίῳ . . . εἶτα τῇ κεφαλικῇ χρῶ, ἀποστήσονται γὰρ λεπίδες . . .

one side and dull on the other.¹⁰⁰ Galen indirectly affirms that it was thin and sharp solely on one side by contrasting it with the *πρόμηκες μαχαίριον* that he invented to dissect along the spine: the latter, he says, has two sharp edges and is thicker than the *skolopomachairion* (*Anat. Proc.* 2.682K = 11.521Gar).

We hear nothing of the handle but, as the phlebotome is several times recommended as an acceptable substitute for the *skolopion* (Paul 6.50.2; 6.55.1), it was in all likelihood one featuring the usual leaf shaped dissector.

Polyp Knife

By the first century a special knife for the removal of nasal polyp had been developed. We first encounter it in Celsus (7.10; cf. also 6.8.2B) and next in Soranus (*Gyn.* 4.11.3 Ilberg = 4.5.78 BGM), where it is called *πολυπικὸν σπαθίον* (*polupikon spathion*). This remains its most common name, though a number of others also occur. These include *πολυποτόμον σπαθίον* (Aëtius 16.116.6; Leon Iatrosophistes, *Consp. Med.* 4.2.3) and, on *Lists*, possibly *ρίνοσπάθιον* and *πολυ<πο>σφάκτης-ήρ*.¹⁰¹

Paul gives the fullest description of the instrument in his treatment of nasal polyp (6.25.2):

When we have seated the patient in direct sunlight and dilated the nasal passage with our left hand, with our right we cut around the polyp or growth in a circle with a polyp knife, the pointed blade shaped like a myrtle leaf (*τῷ μυρσινοειδεῖ ἀκμαίῳ*), directing the point of the blade to the places where the polyp has adhered to the nose. Then we turn the instrument around and extract the undercut growth with its spoon (*τῷ κυαθίσκῳ αὐτοῦ*).¹⁰²

100 *κάπεται τοῦ σχολοπομαχαίριου τὴν ἀκμὴν αὐθις κατὰ τὴν πρώτην ἐμβαλόντες διαίρεσιν, ὡς τὴν μὲν ὀξεῖαν αὐτοῦ πλευρὰν τῇ ἔσωθεν τοῦ δέρματος ὑψηρόμῳσθαι σαρκί, τὴν δὲ ἀμβλείαν τῷ ὀσφῷ, διωθῆσομεν αὐτὸ ἄχρι τῆς μέσης διαιρέσεως...*

101 For *Lists* see Schoene (1903) 283, Bliquez (1983) 197, 202, and Fischer 39(60) & 36(31) who proposes *rhinospathion* simply as a combination file and spatula. Among the mss. transmitting Paul (D & F) the variant *πολυποδικὸν σπαθίον* occurs. This was accepted and included by Milne.

102 *καθέδριον τοῖνον τὸν ἄνθρωπον πρὸς ἡλιακὴν ἀκτῖνα σχηματίσαντες καὶ τῆς ῥινὸς τὸν πόρον διὰ τῆς ἀριστερᾶς χειρὸς ἐκπετάσαντες τῇ δεξιᾷ χειρὶ πολυπικῷ σπαθίῳ τῷ μυρσινοειδεῖ ἀκμαίῳ κατὰ κύκλον τὸν πόλυπα ᾗτοι τὸ σάρκωμα περιτέμωμεν, καθ' ἃ μέρη προσπέφυκε τῇ ῥινί, κατ' ἐκεῖνα τὴν ἀκμὴν ἐντιθέντες τοῦ σιδήρου. μετὰ δὲ ταῦτα τὸ ὄργανον ἀντιστρέψαντες τῷ κυαθίσκῳ αὐτοῦ τὸ ὑποτετμημένον σαρκίον ἔξω κομίσόμεθα.*

Paul goes on to say that if any bit of the growth remains, we should “take another polyp scraper” (λαμβάντες ἕτερον πολυποξύστην) and remove the remaining tissue with its sharp curette (διὰ τοῦ ἐπάκμου αὐτοῦ ξυστρίου) by stretching, turning and firm scraping.”¹⁰³ Paul’s introduction of the term *polypoxustes*, which we never come upon again in the literature, may be another name for the *polupikon spathion*; if so, by ‘another’ he might mean a type with a different spoon, whether in shape or sharpness of its lip, etc. He could also refer to such a spoon alone, without the blade (compare the lithotomy knife and its hook treated below).

Milne (1907) pp. 93–4 was convinced that by ἕτερον πολυποξύστην, Paul had a forceps in mind, translating *polypoxustes* as ‘polyp eradicator.’ His reasoning was based on Paul’s language (“by stretching, turning”), by Galen’s statement that polyp remnants could be removed with “a small forceps” (λαβιδίῳ), and by what he believed was a surviving example, a ‘forceps-rugine’ combination in the kit of the Surgeon of Paris (Fig. 54).¹⁰⁴ The case is weak. The element ξυ- in πολυποξύστην points to a scraping tool as does the ξυ- of ξυστρίου, which is said to be ‘sharp’, not ‘at the end’, as Milne understood ἐπάκμου. And while Galen does refer to a forceps, it would appear merely to be a simple tweezers type, not a special forceps with a rugine. As to the Paris forceps cited by Milne, it turns out under further examination to mount not a rugine but an elevator (Jackson 1986 p. 139 note 56). Note a very similar elevator forceps combination from Aschersleben (Fig. 38.2). Finally, although Paul’s terms “stretching, turning” certainly suit a forceps, they do not preclude a spoon/curette for scraping, which is the position favored here.

Myrtle leaves have ovate or lanceolate leaves. In this regard they resemble some Greco-Roman spatulas, which explains why the polyp knife is termed a *spathion* or ‘little spatula.’ Celsus likewise refers to the blade as made like a spatula (*ferramento acuto modo spathae facto*). But to extract the polyp he employs a curved tool (*unco ferramento*), which looks to be independent of the knife.¹⁰⁵ This presents two possibilities. Either, a hook, like the lithotomy hook (see below), was used for the purpose in the first century CE and was later replaced by a *kuathos*/scoop before we get to Paul’s account, or Celsus’ *uncus* was always the same as Paul’s *kuathiskos*.

For an instrument developed for a specific purpose, the polyp knife was used in a surprising number of other interventions. In addition to treating nasal

103 λαβόντες ἕτερον πολυποξύστην διὰ τοῦ ἐπάκμου αὐτοῦ ξυστρίου τὸ περιλειμμένον σῶμα μετὰ τάσεως καὶ στροφῆς καὶ ξύσεως εὐτόνου κομίσόμεθα.

104 Galen, *Cmpds. by Place*, 12.687K; Deneffe (1893) Pl. 5, fig. 6 = Pl. XXVII, Fig. 1 in Milne).

105 7.10: *Ubi abscissus est, unco ferramento extrahendus est.*

polyp, it was also deployed to divide the head of an impacted hydrocephalic embryo or to drain it of blood (Soranus, *Gyn.* 4.11.3–5 Ilberg = 4.5.76–86 BGM; Paul 6.74.3),¹⁰⁶ to puncture the amniotic sack (Paul 3.76.3), to divide a membrane blocking the auditory canal (Paul 6.23.1), to separate adhesion of foreskin and glans (Paul 6.56.1), and to excise thymi (Aëtius 16.117.13 [Philumenus]), poros/tophus (Oribasius, *Coll. Med.* 45.6.3), and a fleshy growth on the cervix (Aëtius 16.116.6). Its employment in narrow passages like the nose, ear, and the female organs indicates that the polyp knife must have featured a fine blade mounted on a shaft at one end and a small scoop at the other.

Oddly, the fairly abundant literary references are not reflected in readily recognizable recovered specimens. One possibility is the sharp spoon/knife combination in a set from Italy now in the British Museum (Fig. 3, middle of bottom row, below forceps).¹⁰⁷ Unfortunately, the blade is now missing and its shape therefore undetermined. Milne saw the type in two pieces recovered on French soil but his identifications have not been accepted.¹⁰⁸ Two cutting instruments in the Meyer-Steineg collection (11.5 and 14.2 cm in length), all of copper, attract interest because they feature sharp spoons at one end of a shaft and a blade at the other (Fig. 19a).¹⁰⁹ Unfortunately, in neither case can the blade be said to be shaped like a myrtle leaf. A similar third piece (Fig. 19b) does terminate in the form of a myrtle leaf but the ‘leaf’ is identified as a spatula not a blade.¹¹⁰ Finally, none of these items, said to be from Ephesus, can be traced to a secure medical provenience.¹¹¹ Still, they do answer generally to the literary descriptions of an unusual instrument and should, therefore, not be totally disregarded.

Amphismile/Amphismilon?

The name *amphismilon* occurs in the manuscripts of Galen’s *Anatomical Procedures* 581K and some editors read the form *amphismile* at 574K, where the topic is a series of *elasmata* or instruments with blades/shafts used in

106 So too Aëtius 16.23.17, 42, & 48 where τῷ πολυ<πο>τόμῳ, τῷ πολυ<πο>τόμῳ σπαθίῳ, and τὸ πολυ<πο>τόμον are surely what Aëtius wrote for τῷ πολυτόμῳ, τῷ πολυτόμῳ σπαθίῳ, and τὸ πολυτόμον as transcribed by Zervos.

107 Jackson (1986) 121(6) & 136.

108 (1907) 39–40 and pl. VIII, 1 (said to be made of steel). Jackson is skeptical (1994) 170 and note 6. Védrenes figures the same instrument (1876) pl. 1. fig. 7.

109 See Meyer-Steineg (1912) 36, 26, 33 Taf. IV, 4 & 11; Künzl (1991a) 45–46(24 & 26), (1991aa) I 532 (24 and 26) the former now missing).

110 See Meyer-Steineg (1912) 28 Taf. IV, 13; Künzl (1991a) 46(27), (1991aa) I 532(27).

111 See Künzl (1991a) 25–28, (1991aa) I 521–24.

dissection.¹¹² If accepted, *amphismilon/amphismile* would seem to designate a knife sharp on both sides of the blade. However, Garofalo, the most recent editor makes a case for reading *amphimelon* and *amphimele* in these passages, both names seemingly designating probes (see ss.vv. under Probes).

One would be content to leave the matter there were it not for the occurrence of *amphismile* among the letters and orations of Michael Italicus, medical instructor (διδάσκαλος ἱατρῶν) at the Pantocrator Monastery in the 12th century.¹¹³ Michael includes *amphismile* in a sequence of names for probes that is strikingly similar to the sequence in *Anatomical Procedures* 574K.¹¹⁴ As he was quite familiar with Galen, and possibly with this very passage, we have to allow that Galen wrote *amphismile* there, meaning that the name and the knife so designated existed in Galen's time.

Spatula Knife (Spathion)

In dissecting the brain Galen describes raising the anterior column of the fornix “with the olivary enlargement of a probe (see Olivary Enlargement [πυρήν/*baca*] under Probes), or with “the flat part of what are called *spathia* or even that of a spatula probe” (*Anat. Proc.* 2.724K = 11.571Gar: τὸ πλατὺ μέρος τῶν καλουμένων σπαθίων ἢ καὶ σπαθομήλης). It is obvious that by *spathia* Galen intends flattened objects like the spatula on a spatula probe (see s.v. under Probes). Similarly Oribasius urges preparation of a medicament which one boils while stirring a hundred times with a *spathion* before applying (Oribasius, *Ecl. Med.* 112.4; cf. *Hippiat. Ber.* 26.38.11). It seems then that a variety of spatula is designated by the name *spathion* and that this instrument sometimes lies behind the constant occurrence of the verb σπαθίζω and its compounds in pharmaceutical texts.¹¹⁵

However, other references to the term *spathion* clearly indicate that a cutting instrument is at issue. Aëtius for example excises epulis “with a slender little scalpel or better the *spathion*” (8.27.16: σμιλαρίῳ στενῷ ἢ μᾶλλον τῷ σπαθίῳ), and both he (16.89.20) and Paul (6.73.2) lance abscess of the womb with the same instrument. Finally, the late veterinary collection known as *Hippiatrica* recommends dissecting out choiras (scrofulous gland/goiter) with the *spathion* (*Ber.* 20.2.8 and 7.12). Though no further details are given, based on the name

112 See Garofalo's apparatus criticus add. locc., 11 389 and 397.

113 Michael Italicus, *Lettres et Discours*, ed. P. Gautier (Paris, 1972) 114. For a brief synopsis of his career, see Plinio Pioreschi, *A History of Medicine: Byzantine and Islamic Medicine*, vol. 4 (Omaha, Horatius Press, 2001) 91.

114 σπαθομήλην καὶ ἀμφισμίλην καὶ μηλωτίδα . . .

115 E.g., Oribasius, *Ecl. Med.* 89.22; Paul 7.17.15.10 and 7.17.17.5.

spathion and the operations involved in these passages, it looks as though a spatula shaped knife with a fine pointed blade, sharp on both sides, is wanted.

In one instance Soranus (*Gyn.* 4.10. 2 Ilberg = 4.5.31–32 BGM) makes a cut in the fetus with a *spathe* (σπάθη) to insert an embryo hook (see s.v. under Retractors and Hooks).¹¹⁶ *Spathe* is the name commonly given to the spatles used for stirring medicines, in contrast to *spathion*, which is seldom used in this sense (see Instruments for Stirring under Vessels/Containers). But clearly the name designates a knife for Soranus and likely the same knife as the *spathion*.

It is tempting to see as a surviving *spathion* a well preserved robust spatula shaped blade of steel mounted opposite an olivary enlargement which recently came to light in Rimini (Fig. 11.5).¹¹⁷ The combination olivary enlargement and sturdy blade with bilateral cutting edge looks well suited for Galen's exploration of the fornix just mentioned.¹¹⁸ Yet, the frequent coupling of *spathion* with the adjective *polupikon* to designate the polyp knife (see below, *polupikon spathion*) makes it likely that, while the name could apply to any surgical knife featuring a spatula-like blade, the polyp knife may be mainly at issue. One notes how Soranus of Ephesus, while treating of embryotomy, comfortably alternates between calling the knife used *polupikon spathion* and just *spathion* (4.11.3–5 Ilberg = 4.5.76–86 BGM). So too Celsus describes the knife used to remove nasal polyp as a *ferramentum acuto modo spathae factum* (7.10).

One last passage needs to be discussed. Paul in detailing the nasty procedure known as hupospathismos elevates the flap of flesh overlying the veins of the forehead with the *spathion* (6.6.1). Here, though, it is apparent that by *spathion* he means no more than the *hupospathister* (see s.v. under Bone and Tooth Instruments), the large spatula that takes its name from the operation.

Half Spatula Knife

The usual term in Greek for this knife is ἡμισπάθιον/*hemispathion*.¹¹⁹ Only Oribasius and Paul employ it but it clearly existed in the first or second century, as Paul once identifies his source as Leonides. The *hemispathion* is brought to bear exclusively in rectal and vaginal operations. Paul removes growths

116 ὅταν δὲ τῶν εἰρημένων μηδεὶς εὐρίσκηται τόπος, εἰς κατάπαρσιν ἐτοιμάζεται σπαθὴ διαίρεσις. There is surely a connection between *spathe/spathion* in the sense of a cutting instrument and the broadbladed sword of the same name.

117 Jackson (2003) 317, (2009b) 78 & 88.

118 Jackson (2009b) 78 & 88 sees in this specimen the type of sturdy blade Galen recommends for opening the vertebral canal in *Anatomical Procedures* 2.673K.

119 If the text is correct, we once find an adjectival form in Oribasius, *Coll. Med.* 44.20.57: ἡ τοῦ ἡμισπάθου (sc. σμιλίου) ἀκμή.

like thymi, condylomata and hemorrhoids from the female parts by steady-ing them with a forceps and excising them with the *hemispathion* (6.71.1), while Oribasius opens rectal abscess with the instrument (*Coll. Med.* 44.11.4). Oribasius also recommends it for cutting into anal fistula, using the shaft of a probe as a block (*Coll. Med.* 44.20.57 & 66 [Antyllus, Heliodorus], followed by Paul 6.78.4 [quoting also Leonides]). Three of these passages refer to the ἀκμή of the instrument, which could mean either the point or the blade, probably the latter. As the instrument was used in narrow orifices, it likely was not sharp on both sides but only on the one employed in cutting. The fact that Oribasius could substitute a fistula knife (see below) for the *hemispathion* is in keeping with such a blade.

As its name shows, the *hemispathion* was shaped like half of a spatula. There is in the Naples Museum a shaft of copper alloy, which mounts a small dissector on one end and a semispatula resembling a blade of the bellied type on the other.¹²⁰ The general resemblance of this item to the common oval shaped spatula with an olivary enlargement is striking, and might have prompted the ancients to refer to the Naples tool as ‘the half spatula.’ But the *hemispathion* was a cutting instrument and therefore its blade was more likely fashioned of iron or steel. In any case, we know nothing of the provenience of the Naples piece, meaning that it cannot be shown that it was ever used for surgery.

There is a more attractive possibility. If the name *hemispathion* was occasioned by the resemblance of this instrument to a spatula of the oval type cut in half lengthwise, then we could merely be dealing with another name applied to a small version of the common scalpel type with the ‘bellied’ or D-shaped blade (Fig. 2, top row; Figg. 9 and 11.1).

Lithotomy Knife (lithotomon)

Although the operation for bladder stone is mentioned in the *Hippocratic Oath* (4.17L), the first extensive description of the procedure is provided by Celsus (7.26.2). His patient is a boy, in keeping with the fact that boys in particular suffered from the condition (see also Paul, 6.60.1; [Hippocrates], *Nat. Man.* 6.12L). The nature of the male urinary tract was felt by the ancients to be the cause, but moderns suspect diet of playing a role.¹²¹

120 Bliquez/Jackson (1994) 121(52); similar ‘Lanzetten’ preserved in the Louvre are shown in Snyder (1972) 30(11). Künzl (1984b) 187(X3) & Taf. 29 figures a post-classical piece, which is taken as a molding tool.

121 See Jackson (2010) 395–396.

Now to the actual surgery. Once the boy was put into the proper position with the help of attendants, Celsus has the surgeon insert his left index and middle fingers into the rectum, probe for and find the stone, maneuver it into the neck of the bladder, and press it outward until its outline can be seen against the perineum. Two antithetical semilunar incisions are then made with a scalpel (*scalpellus*), one to reach the neck of the bladder and one to cut into it. When the stone comes into view, it is extracted with the fingers or a hook (7.26.2K). Celsus gives the bland name *uncus* to the hook but, fortunately, he provides a detailed description: the *uncus* should be thin, beaten into a semicircular shape, smooth on the outside, rough on the inside so as to engage the stone firmly, and mounted on a long shaft.¹²² Throughout he stresses that great care must be taken not to injure the bladder. Celsus then goes on to describe the different procedure used in the rare cases arising in girls and women.¹²³

Clearly, Celsus was employing two instruments for the operation, a scalpel, and an *uncus*. That it would be convenient to combine the instruments was soon seen. When we reach Rufus of Ephesus, perhaps as little as fifty years later, we find just this arrangement (*Dis. of Kidney and Bladder* 12.12.4–13). Rufus has no special name for the instrument he recommends, simply referring to it with the Hippocratic term for scalpel (*machairion*). In this case the *machairion* happens to have a hook, which he calls a handle (λαβή), rough and bent at the tip.¹²⁴ The term “lithotomy knife (λιθοτόμον/*lithotomon*)” first appears without elaboration in Pseudo-Galen.¹²⁵ This is the name used in Paul (6.60.2), who gives

122 *Si maior (sc. calculus) iniciendus a superiore <ei> parte uncus est eius rei causa factus. Is est ad extremum tenuis, in semicirculi specie <m> retusae latitudinis, ab exteriori parte levis, qua corpori iungitur, ab interiori asper, qua calculus attingit isque longior potius esse debet: nam brevis extrahendi vim non habet.*

123 The surgery on females is described twice: by Celsus (7.26.4) and later by Aëtius (16.111) whose account is likely taken from Aspasia. As in the case of males, in females too the operator must force the stone into the neck of the bladder with the index and middle fingers. Whereas in males the stone is accessed through the rectum, in females access is through the vagina, though rectal access is advised for virgins. When the stone has been digitally maneuvered into position, it is forced upward until its outline appears: above the greater labia, according to Aëtius, or between the urethra and the pubic bone, according to Celsus. It is then exposed by incision, and extracted by the *lithoulkos*. For the mysterious Aspasia see Paul Keyser's entry in Keyser and Irby-Massie (2008) 173 and Scarborough (2013).

124 ... εἰ μὲν πρόχειρος εἴη (ὁ λίθος), τῇ λαβῇ τοῦ μαχαίριου ἐκβάλλειν, πεπιεσμένον δὲ τῇ λαβῇ τραχεῖα τε καὶ καμπύλη ἐξ ἄκρου ...

125 *Thrasylbulus Best Sect* 1.125K.

the only other full description of the operation, with some differences from Celsus.¹²⁶ *Lithotomon* is the name that finds its way onto *Lists*.¹²⁷

Ten specimens of the *lithotomon* survive. Each once mounted a steel blade, now missing; thus one can only guess at the form it assumed. The general feeling is that it was sharp pointed and cutting on both sides.¹²⁸ On the other hand the hook of copper alloy at the other end is well preserved in each case. In accord with the literary testimonia it is flattened and roughened on the interior. Three of these pieces are in Mainz. Of these, two form part of an instrumentarium from Asia Minor, probably mid 3rd century Ephesus (Fig. 20, 1st and 2nd from rt.; Fig. 29, bottom). There are in addition two in a set in Cambridge, England, said to be from the Roman Campagna (2nd century), and another three in another one recovered in a house burnt down at Marcianopolis (Devnja) in the late 4th or early 5th century.¹²⁹ All these pieces answer to the descriptions found in Celsus and Rufus and all date to the period when the name *lithotomon* was in circulation. They are vivid testimony to specialization centering on the bladder and urinary tract.

The Mainz and Cambridge kits also include the same roughened hooks without complimenting knives (Fig. 20, 3rd from rt.) and another has lately surfaced at Rimini (Fig. 11.11). These show that a lithotomy hook separate from the knife never went out of vogue. Aëtius (16.11.13) and Paul (6.60.2.24) in their treatments of lithotomy mention, in addition to the *lithotomon*, an instrument they call λιθουλκός/*lithoulkos* or 'stone extractor', a tool Oribasius also recommends for prying up poros/tophus. That this was a kind of hook is clear from his reference to its bend (τὸν πῶρον κομίζεσθαι . . . ἢ λιθούλκου καμπῇ, *Coll. Med.* 45.6.6); *lithoulkos* was, therefore, the proper Greek term for the hook by itself, or, when specified, on the *lithotomon* (see below Lithotomy Hook, under Retractors and Hooks).¹³⁰

As noted, for reaching the stone under ordinary circumstances Celsus employs a *scalpellus*. However, he goes on to treat of a special type of lithotomy knife, sturdier than a scalpel, especially designed to cope with a projec-

126 It is worth consulting the lengthy critical review of all the Greco-Roman and Arab sources for lithotomy produced by Francis Adams for this chapter of his translation of Paul (vol. 3, 356–363).

127 Schoene (1903) 282; Bliquez (1984) 200; Fischer (1987) 37(44).

128 Milne (1907) 41; Meyer-Steineg (1912) 20.

129 Künzl (1983b) for Mainz and Cambridge; for Devnja see Minchev (1983) 145, Kirova (2002) 78–79, and now Jackson (2010) who provides a full catalogue of all the tools used in the procedure.

130 Bliquez (1985) 119–121.

tion (*aliqua prominentia*) on 'spiny' (*spinossi*) stones. The invention of this tool he attributes to the surgeon Meges of Sidon, a contemporary who impressed Celsus as being *eruditissimus*.

Unfortunately, Celsus' language is ambiguous enough to promote different views of the shape of Meges' lithotome.¹³¹

...*ferramentum fecit (Meges) rectum, in summa parte labrosum, in ima semicirculatum acutumque. Id receptum inter duos digitos, indicem ac medium, super pollice inposito, sic deprimebat...*

... Meges created a straight instrument, on its uppermost part liplike and at base semicircular and sharp. He pressed it down when taken between two fingers, the index and middle, with the thumb positioned above, ... (7.26.2 N–O, translation mine):

The primary difficulty lies with the phrase *in summa parte labrosum*. Does *labrosum* ('having to do with/reflecting lip/lips') mean that the instrument was curved like a lip? And to what does *in summa parte* refer: the top of the blade or the top of the handle? It must be the latter if the instrument was straight (*ferramentum rectum*), which would seem to refer primarily to its blade if not to the whole. If *in summa parte* refers to the handle, *in ima semicirculatum acutumque* could refer to the tip of blade and mean that it was semicircular and sharp. This was the view taken by Milne, who favored a modified design of the one proposed by Daremberg in 1847 (Fig. 22), based in part on his own experience as a surgeon. Most recently it has been proposed that a knife shown on a physician's gravestone now in Berlin is the one developed by Meges.¹³² The instrument depicted consists of an arched blade with a slender handle that curves in the opposite direction (Fig. 21, 3rd from left). Like the Milne-Daremberg reconstruction, the Berlin depiction fits with Celsus' statement that the handle was to be held between the index and middle fingers with downward pressure (*deprimebat*) being applied by the thumb.¹³³ But if we envisage a curved/arched form, we still run up against Celsus' description of Meges' knife as *ferramentum rectum*. Whether *ferramentum* designates the blade or the entire instrument, something cannot be straight and curved at

131 For various conjectures including his own, see Milne (1907) 41–43 and Pl. VIII.

132 See Antje Krug's excellent presentation of this stone: (2008).

133 Krug pp. 42–43 interprets *in summa parte labrosum* as referring, not to the handle, but to the blade which she reconstructs as arched above and semicircular (*semicirculatum*) on its upward curving underside.

the same time; accordingly *labrosum* must refer to the handle. On the whole Milne's assessment seems to me closest to Celsus' language, but I am uncertain we yet know precisely what Meges' invention looked like.¹³⁴ Like the Scoop of Diocles or Heron's Cupping vessel (see above: Cupping vessels) it was probably a virtuoso instrument that never enjoyed wide popularity in any case. If it did, one might expect to see a knife reconcilable with Celsus' description among the many authenticated tools we now possess, especially among the three recovered instrumentaria focusing on lithotomy (Mainz, Cambridge, Devnja).

Tonsillotome

Celsus offers the first description of tonsillectomy, using a standard sharp hook/retractor (*hamulus*) and, apparently, an ordinary scalpel (*scalpello excidere*, 7.12.2). Pseudo-Galen gives no details of interest as to the procedure, but we meet for the first time what appears to be a knife specifically designed for it, the ἀντιστόμον (*antiotomon*) or tonsillotome (*Intro. or Physician* 14.785K = Petit 19.10). The name is otherwise unattested in classical sources but finds its way onto *Lists*.¹³⁵

Paul (6.30.2) is the best source for both the operation and the instruments used in it. These include a tongue depressor (γλωσσοκάτοχος), a sharp hook to pierce and expose the tonsil, and the tonsillotome, which Paul calls ἀγκυλοτόμον (*ankulotomon*). The first element in the compound *ankul*—('bend of the arm or another limb') indicates that the instrument was curved. Paul goes on to confirm this. He says that there were two such instruments available as a set and that they featured opposing curvatures for cutting (δύο γὰρ εἰσιν ὄργανα τοιαῦτα ἀντιτόμους ἔχοντα τὰς ἐπικάμψεις). Paul must mean that his tonsillotomes were bowed or curved in two planes, since a flat knife, sharp on both sides, could simply be turned over to reverse its curvature, thus negating necessity for a set of two. Paul's knives, therefore, (and presumably Pseudo-Galen's) assumed approximately the shape of the modern left and right knives used for tonsillectomy.¹³⁶ This explains why Paul adds that one operates with the *ankulotomon* suited to that hand (κατὰ χεῖρα).

The dearth of literary references suggests these special knives may not have been widely used, a view corresponding to the absence of a convincing

134 Nor can I identify the instrument the Berlin stone represents. I would feel more comfortable about the views just expressed if I could.

135 Schoene (1903) 281; Bliquez (1984) 198; Fischer (1987) 39(59).

136 See the *Catalogue of Surgical Instruments of Superior Quality* offered for sale by Biddle and Crouther Inc. of Seattle, WA., (24th edition, 1935) 233.

specimen until lately.¹³⁷ Once again, however, the fabulous find in the Domus 'del chirurgo', Rimini, provides a pair of knives featuring curved/bowed blades that are consistent with Paul's description of the tonsillotome; these have been identified as such by Jackson.¹³⁸ They are inserted into the standard octagonally sectioned handle surmounted by a leaf shaped dissector (Fig. 23).

Knife for Excision of the Uvula (staphulotomon)

Excision of diseased uvula is mentioned in the *Hippocratic Corpus*¹³⁹ but Celsus first details the procedure. He draws down the uvula with a forceps (*volSELLA*) and amputates it, apparently with a simple scalpel (7.12.3). Paul (6.31.2), however, mentions a special knife for the operation. This he calls a σταφυλοτόμον (*staphulotomon*) or uvula knife. The name reoccurs in the *Liber Esculapii* and surfaces again on *Lists*.¹⁴⁰

Paul says nothing of the physical appearance of the instrument. He merely directs the surgeon to hold the uvula down with a *staphulagra* (see Uvula Forceps, under Forceps), or an ordinary forceps and cut away the redundant portion of the uvula with the *staphulotomon* or with the suture knife (see above, s.v.). Meyer-Steineg ([1912], 35) guessed that the *staphulotomon* might have been a small curved knife with a cutting edge on the concave side. And indeed Albucasis figures such an instrument in his section on uvulectomy.¹⁴¹ Uvulectomy performed by itinerant surgeons with a sickle shaped knife is documented for contemporary subSaharan Africa (see Manni [1984]; Adoga, Nimkur [2011]).

Assuming the *staphulotomon* was a distinct type of knife, it must have been rare. Note that the uvula could be removed with the suture knife, which had wider applications; so most surgeons could do without it and apparently did; hence the rare testimonium to its existence in Paul.

137 Meyer-Steineg saw a possible survival of the tonsillotome in a small curved knife of copper alloy in his collection (1912 35; Taf. IV, 12). Unfortunately, it was no longer available for examination by Künzl (1991) 46, no. 23. A similar small iron or steel blade can be found in an instrumentarium from Kallion; see Künzl (1983a) 42(11.7). Both of these knives appear flat, however, and therefore do not conform to the picture of the tonsillotome drawn above. For other views of Künzl on these pieces see (1992) 238.

138 See Jackson (2003) 315 Fig. 1(2) and (2009b) 75(6), 78 & 88.

139 *Prognostic* 23.22–25L; *Affections* 4P; *Diseases* 2.29P.

140 For the *Liber Esculapii* see Fischer (2012) 50; for *Lists* see Schoene (1903) 283; Bliquez (1984) 203; Fischer (1987) 39(55).

141 Spink and Lewis (1973) 306 with illustration on 303 (Fig. 79).

Fistula Knife

The issue of the *συριγγοτόμον* (*suringotomon*) or fistula knife is complicated by the fact that this and other names for the instrument were clearly used of at least two separate cutting tools.

Paul offers the most detailed description of the instrument's use in a chapter unusual for recording his personal experience with anal fistula (6.78). In cases admitting of surgical treatment Paul says there are two procedures: either one can lay the fistula open with a scalpel (*smilion*), using as a block/director a probe which has previously been pushed through the fistula; or one can employ the *suringotomon*.

... alternatively, when we have pierced the base of the anal fistula with the sharp point of the sickle of the *suringotomon*, then by drawing the instrument from there through the anus we cut through the intervening tissue with the blade of the sickle (6.78.2).¹⁴²

Paul's terminology makes it clear that the instrument used for this purpose was falciform (τοῦ δρεπάνου τοῦ συριγγοτόμου); so also Leon Iatrosophistes.¹⁴³ He also makes it clear that the blade was pointed at one terminus (τῷ ὀξεί). That it should be sharp only on its inner side (τῇ ἀκμῇ τοῦ δρεπάνου) is clear from the requirements of the operation: one only wants to open the fistula without cutting the tissue below. Thus, Paul's meaning is that the pointed terminus, which we might describe as a handle, was first forced into the fistula to be followed by the falciform blade with its cutting edge upright. In this way the fistula was divided as the 'handle' was pulled through. No convincing example survives, but illustrations of contemporary models found in the works of later surgeons like Lorenz Heister and H. Fabricius allow us to envisage the ancient type.¹⁴⁴

That some falciform types also featured an eye at the pointed terminus is shown by Paul's observation that some who employed the Hippocratic

142 ... ἤγουν τοῦ δρεπάνου τοῦ συριγγοτόμου τῷ ὀξεί τὸν πρὸς τῇ ἔδρᾳ πυθμένα τοῦ κόλπου ἐκτρήσαντες αὐτό τε τὸ ὄργανον διὰ τῆς ἔδρας διεκβαλόντες αὐτόθεν ὅλον τὸ μεταξύ τῇ ἀκμῇ τοῦ δρεπάνου διατέμνωμεν...

143 Leon Iatrosophistes, *Conspectus Medicinae* 5.19.3 (τέμνειν τῷ δρεπανοειδεῖ λεγομένῳ ὀργάνῳ). See also Cassius Felix 20.2 (fistula): *melius est fistulam ferro nudare, id est ex flebotomo vel syringotomo appellato*.

144 Meyer-Steineg (1912) 35 & Taf. IV 12 promoted as a candidate a small curved knife of copper alloy in his collection. Unfortunately, it was no longer available for examination by Künzl (1991a) 46(23). A similar small iron or steel blade can be found in an instrumentarium of the 3rd century from Kallion: Künzl (1983a) 42(11.7). For Heister's and Fabricius' illustrations, see Milne (1907) 47–48 and Pl. IX(1).

remedy of ligating anal fistula (apolinosis) passed the linen thread for the purpose through the fistula “in the eye of the sickle for fistula” (ἐν τῷ τρήματι τοῦ συριγγιακοῦ δρεπάνου, 6.78.3). In this case, a model with a dull blade, or one dulled for that purpose, would have to be employed.

Paul also refers to use of the *suringotomon* in opening imperforate vagina (6.72.1)¹⁴⁵ and, with Galen (*Meth. Healing* 10.415K = J-H 2.162–163) as his source, to its application in enlarging the wound through which intestine and/or omentum have prolapsed in order to restore the protruding part(s) to their proper position (6.52.1). For the latter operation it is clear that another type of *suringotomon* was used because Paul here recommends straight *suringotoma* (τὰ καλούμενα ὀρθὰ συριγγοτόμα). That these featured blades sharp only on one side and dull on the point is shown by Galen who observes, “two sided knives or those sharp at the point are to be avoided in every way.”¹⁴⁶ These were very probably the type used for imperforate vagina, and I incline also to identify them with the σπαθίον συριγγοτόμον mentioned in another part of Paul’s chapter on anal fistula. Here he draws on Leonides who, when confronted by a blind fistula, forces a probe into its orifice after its exposure by dilation. He adds: “using its shaft as a block, let the whole fistula be divided by a *hemispathion* or by the *spathion suringotomon*” (6.78.4).¹⁴⁷

For enlarging a wound or dealing with imperforate vagina a handle seems desirable. So this variety of *suringotomon* was probably only a regular scalpel with a suitable blade, perhaps a fine model featuring a dull point and one cutting edge; ee.gg., Fig. 11.6–7.

As in the case of so many specialty instruments designed for operations that could be performed by other more common tools, the *suringotomon* probably was not widely employed. Most fine bladed scalpels would do just as well. Minority usage is suggested by Oribasius’ statement, derived from Antyllus and Heliodorus, that a fistula could be divided by “the blade of the *hemispathon* or the *syringotomon* that is procured by some” (ἢ τοῦ ἡμισπάθου ἀκμὴ <ἢ> τοῦ ὑπὸ τινων κατασκευαζομένου συριγγοτόμου, *Coll. Med.* 44.20.57).

The name *suringotomon* is included on *Lists*.¹⁴⁸

For a falciform knife used in embryotomy, see Embryo Hook, under Gynecological and Obstetrical Instruments.

145 As did Soranus. His missing chapter on atresia survives in Muscio’s Latin translation: . . . *infixo ancistro extendentes syringotomo praecidimus* (11 92, p. 116).

146 ἐπιτήδεια δ’ ἐστὶν εἰς τὴν τοιαύτην τομὴν (enlarging an abdominal wound) τὰ καλούμενα συριγγοτόμα. τὰ δ’ ἀμφήκη τῶν μαχαίρων, ἢ κατὰ τὸ πέρας ὀξεία παντὶ τρόπῳ φευκτέα.

147 ἐπικόπου τε ὄντος τοῦ ἐλάσματος ὅλην διαιρέισθω ἢ σύριγι τῷ ἡμισπαθίῳ ἢ σπαθίῳ συριγγοτόμῳ.”

148 Schoene (1903) 283; Bliquez (1984) 203.

Razor

We hear not infrequently of shaving hirsute areas in treating diseases of the head, especially conditions like alopecia and headache.¹⁴⁹ Galen provides one of many references to the procedure in *Cmpds. by Place* 12.395K:

You have to remove the hair with a razor and then massage the affected skin with a piece of linen, neither too rough nor too soft.¹⁵⁰

Oribasius recommends cutting the hair with knives (*Coll. Med.* 10.15.2) before applying the razor,¹⁵¹ called in Greek ξυρόν (*xuron*), its diminutive ξύριον, and *novacula* in Latin. Pharmaceutical applications regularly follow depilation, some of them quite lethal to judge by Alexander of Tralles' prescription for psoros and serous excretions (*Therap.* 1.461.9–11):

Make a paste of rue, alum and honey and anoint the head, shaving it in advance. If the skin comes free of the head, plaster the area over with boiled olive leaves mixed with honey.¹⁵²

Other conditions requiring depilation by razor are: epilepsy (Oribasius, *Ecl. Med.* 36.6; *Syn.* 8.3.10), hearing problems (Alexander of Tralles, *Therap.* 2.103.26), ophthalmia (Alexander of Aphrodesias, *Problems* 2.36.1),¹⁵³ memory loss (Leon Iatrosophistes, *Consp. Med.* 2.15.3), catarrh (Oribasius, *Syn.* 9.1.1), trauma to head (Oribasius, *Coll. Med.* 46.8.1 & 46.18.2), and treatment of varicose veins (Oribasius, *Coll. Med.* 45.18.3). All but the latter involve shaving the head.¹⁵⁴

149 Alopecia, headache, etc.: Celsus 6.4.3; Galen, *Cmpds. by Place* 12.581K [Charicles]; Aretaeus, *Care Chron. Diseases* 1.2.3 & 11; Oribasius, *Coll. Med.* 46.30.2, *Ecl. Med.* 4 & 5, *Syn.* 8.22.5, *Eunap.* 4.5.6 & 4.6.3; Alexander of Tralles, *Therap.* 1.445.17 & 1.461.10. Headache: Oribasius, *Eunap.* 4.1.9, *Syn.* 8.17.7; Alexander of Tralles, *Therap.* 1.495.17. Also Oribasius, *Coll. Med.* 10.12.3 (application of plaster to head and pubes [Antyllus]); Nicander, *Alexipharmaca* 411.

150 ἀφελεῖν μὲν χρὴ ξυρῶ τὰς τρίχας, ἀνατριβεῖν δὲ τὸ πεπονθὸς δέρμα δι' ὀθόνης μήτε πάνυ τραχείας μήτε μαλακῆς.

151 ἐπὶ δὲ κεφαλῆς ἀφαιρεῖν πρῶτον τὰς τρίχας δεήσει μαχαίραις, εἴτα ξυρᾶν, εἴτα καὶ ἀναξυρήσει χρησθαι.

152 πήγανον καὶ στυπτηρίαν λεάνας μετὰ μέλιτος χρίε τὴν κεφαλὴν προξυρῶν· ἐὰν δ' ἀφιστήται τῆς κεφαλῆς τὸ δέρμα, ἐλαίας φύλλα ἐφθὰ μετὰ μέλιτος κατὰπλάττε.

153 Alexander expresses the view that shaving allowed the head to breathe and thus dissipate through open pores the "secretions and rheum" causing ophthalmia.

154 Of general or indeterminate application are: Galen, *Cmpds. by Place* 12.453K (preparation διὰ ξυροῦ for depilatories) and Oribasius, *Ecl. Med.* 77.1 (itch, etc.).

Small knives proposed as razors are found at settlement sites (e.g., at Augst) but I cannot produce a recognizable example in any surgical context.¹⁵⁵ This makes one wonder if shaving was not just as likely to be performed with a keen edged scalpel. If so, that may explain why we mostly find shaving in the literary sources expressed in a general way by the verb ξυρᾶν and its compounds, without specific reference to the *xuron*.

Bow Shears

Specimens of scissors (that is, a pair of blades terminating in looped handles and revolving on a bolt) cannot be securely documented for classical antiquity.¹⁵⁶ The common scissors-like instrument during that period, and the only one found in surgical contexts is a shears constructed of blades mounted on a bow handle (Fig. 1, bottom row, far rt.; Fig. 24; Fig. 89, bottom row). To these shears were applied the names ψάλις (*psalis*) in Greek and *forfex* in Latin.¹⁵⁷

Both copper alloy and iron/steel specimens survive, but the latter is much more frequently come upon, and only it can be authenticated for surgical contexts. Iron/steel shears are included in the instrumentaria of the Casa del Medico Nuovo (11) in Pompeii¹⁵⁸ and graves in Ladenburg (2), Nijmegen, Mérida, Verona (2), Balčik,¹⁵⁹ and Nea Paphos,¹⁶⁰ nine examples in all. The fact that iron/steel models admitted of a keener edge probably explains the reason for their preference.

Galen includes shears among the most common surgical instruments.¹⁶¹ While references to the tool itself are not correspondingly frequent in the literature, ample use of the verb ψαλίζειν attests their utility. Shears were in the main employed to harvest herbs (Aëtius 3.131.4; 6.10.86) and in parasurgical

155 See Riha (1986) 28–31. Some of the Augst specimens are jackknife types. The jackknife published (but not visible) along with tools in the Italian set shown on Fig. 3 is not believed to be directly associated with them: see Jackson (1986) 131(39) and 164.

156 See Kirkup (2006) 248. For claims to the contrary, see Bliquez (1982) 211(29), Hamarneh, Awad (1977) 522(3) and Johnston (1957) 209(Priene). However, the context of these specimens is uncertain. S. Reinach in Daremberg Saglio *Dict. des antiquités grecques et romaines, etc.*, 11/2 1241 s.v. *forfex* treats only bow shears.

157 So *Herm. Mon.* 207.45: *psalides forfices*.

158 Bliquez (1984) 38 & 84.

159 Künzl (1983a) 79 (Germ. Sup. 3), 93 (Germ. Inf. 8), 102 (Hisp. Lusit. 3), 104 (Ital. 2), 111 (Moes. Inf. 3).

160 Michaelides (1984) 318.

161 *Comm. Hipp. Epidem.* 5, 17b.231K: κλυστήρας καὶ φλεβοτόμα καὶ σμίλας καὶ ψαλίδας καὶ καυστήρας καὶ τᾶλλα τῆς ἰατρικῆς τέχνης ὄργανα.

operations to prepare sutures, ligatures, bandages, and dressings.¹⁶² For example, the famous Antyllus cuts with shears the threads that he applies as ligatures in treatment of aneurysm (Oribasius, *Coll. Med.* 45.24.8), and Oribasius records a similar procedure in ligating varicose veins (cf. *Coll. Med.* 45.18.15). Again, to facilitate bleeding with leeches Antyllus (Oribasius, *Coll. Med.* 7.21.6) and Galen cut their tails off with shears (*Leeches, Revulsion, Cupping, etc.* 11.318K).

We also hear of use of shears in a few actual surgical procedures. Though he prefers the scalpel Paul cuts away thymi, a warty growth on the penis, with shears (6.58.1), and he records that Antyllus employed a particularly sharp pair or a scalpel (ψαλίδι ἐπάκμω ἢ σμίλῃ) to remove the excess skin of a pendulous scrotum, a condition called rhacosis (6.67.1). Celsus records the most daring procedure: he shears off any of the omentum that has mortified in cases where, through an accident or wound, the intestines are exposed (*forfice excidi debet* 7.16.3).¹⁶³ He also notes that some cut away the omentum with shears in repairing scrotal hernia; but he does not recommend the procedure and denies that the situation with exposed intestines can be used as a precedent (7.21.1C).

Both ψαλὶς and *psallidium* appear on *Lists*.¹⁶⁴

Probes (Including Spatulas and Spoons)

Taken collectively, the probe is probably referred to more frequently in the literature and preserved in greater numbers in surviving instrumentaria than any other kind of instrument. The classification is extremely broad, the types varying from simple rods to models mounting spatulas, spoons, scoops, and even hooks. For this reason, spatulas, ligulae and spoons have been included in this section.

162 Galen, *Cmpds. by Kind* 13.685K; Oribasius, *Coll. Med.*: 7.21.6; 10.13.27; 43.36.42; 44.12.11; 46.19.12; 48.50.1. For their use in veterinary medicine, see *Mulomedicina Chironis* 64.

163 Galen may have performed the operation with such a tool on a wounded gladiator: see May's translation of *On the Usefulness of the Parts of the Body* vol. 1.215 (= 3.287K). In veterinary surgery we hear of a similar operation (*Hippiat. Paris.* 151.7 and *Hippiat. Ber.* 71.1: δεῖ γαστρορραφεῖν τὸ περιτόνιον, ὅνπερ τρόπον οἱ ἱατροὶ ἐν ἀνθρώπῳ). See also *Hippiat. Paris* 723.12 for snipping away lice from bovine tongues with shears. For surgery on the abdomen and those specializing in it see Galen, *Meth. Healing* 10.410–423K = J-H 2.156–181.

164 Schoene (1903) 283; Bliquez (1984) 203.

Few probes were designed specifically as such.¹⁶⁵ The spatulas, scoops, spoons and swab-sticks that were commonly used in the home and shop were also the probes utilized by a physician. For this reason these items ought never to be identified as instruments of surgery (a common practice in publications of minor objects) unless they are found in the company of articles created only or primarily as surgical tools: e.g. specula, cauteries, cupping vessels, scalpels and the like.

Just as the typology of the probe is complex, so too is its nomenclature. The generic name for probe in Greek was μήλη (*mele*),¹⁶⁶ in Latin *specillum*. The latter is mentioned as early as Varro and Cicero, the former from the *Hippocratic Corpus* through to *Lists*.¹⁶⁷ Here we immediately encounter a formidable difficulty in dealing with references to the probe in literature: when *mele* or *specillum* are mentioned without further specification, it is often impossible to determine the type of probe envisaged. Conversely, in some cases more than one name is used for a specific type, which creates a different sort of problem in identification. Sometimes it is difficult to connect archaeological survivals with names (usually rare) that are attested in the literature. So too we find ambiguity in the terminology used to designate the parts of a probe. The name ἔλασμα (*elasma*), for example, can designate, depending on the type of probe, its spatula, scoop, shaft, and perhaps even the olivary enlargement or *puren* (see below) found on most types; it also is a collective term for probes

165 Exceptions may be the *specillum asperatum*/βλεφαρόξυστον, and the τραυματική and οφθαλμική μήλη. But even here it is hard to be sure.

166 With progression of itacism we find the variants μίλη (Galen, *Treat. by Venesect.* 11.300K) and μύλη (Galen, *Cmpds. by Kind* 13.850K).

167 Varro, *Ling. Lat.* 6.82.10 correctly sees *specillum* and *specio* as related: ... *qui oculos inungimus quibus specimus, specillum*. Cicero thinks Aesculapius invented the *specillum* (*Nat. of the Gods* 3.22.57) and clearly regards it as a probing instrument (*Against Piso* 62). The form *speculum* may also have occurred in Late Latin; cf. *Mulomedicina Chironis* 811, where *collirium oculare* is prepared with a small spatula, *deinde sumes speculum et permisces*. More likely *speculum* here is a corruption for *specillum*. The derivation of *mele* is problematic. Some associate it with the Greek for apple or tree fruit (μήλον), prompted by the olivary enlargement (πυρήν) on so many probe types; so Milne (1907) 51. I consider this unlikely because there is no mention of such an enlargement on the Hippocratic *mele*. For *Lists* see Schoene (1903) 282; Bliquez (1984) 200; Fischer (1987) 34(6). The Latin *List Par. Lat.* 11219 also includes *malium*, which I once speculated (197) might be a diminutive form of μήλη. But μήλιον occurs nowhere in the literature. Fischer more attractively conjectures *malleum* or 'hammer': 36(23).

and other instruments.¹⁶⁸ Again, the name *πλατύ* (*platu*) or *πλάτος* (*platos*) can identify a spatula or a scoop/spoon or olivary enlargement on a probe.¹⁶⁹ When a general name for probe like *mele* occurs in the literature in conjunction with these non specific terms, only context can determine their precise meaning and that not always.

The uses of the probe are likewise many and varied. These include: preparation and application of medicaments, plugs/pledgets and the like, measuring, exploring, cauterizing, piercing, dissecting, dilating, threading, cleaning, curetting, depressing, elevating, pressuring, protecting/guarding, directing and retracting.

The probes recovered in archaeological excavation are of copper alloy, occasionally decorated with silver inlay and, very occasionally, are even wholly made of pure silver.¹⁷⁰ In the literature we also hear of tin, lead, wood, limestone (once),¹⁷¹ and various other natural substances (see below). The earliest surgical examples of which we can be sure are probably those included in Pompeian instrumentaria, though claims can be made for recoveries of earlier date.¹⁷²

What follows is a breakdown of the various types of probes, their names and their general uses, followed, where appropriate, by concise catalogues of the specific situations in which they were employed and the sources of this information.

Simple Probe

The sources frequently refer to exploration of an opening such as a fistula, or to tracking a lesion, or to the application of medicament on a swab. For these ends a simple rod of appropriate size would do. Natural substances such as a garlic stalk, a myrtle twig, a swine's bristle or even the human finger are occasionally mentioned.¹⁷³ For anointing or to force a vomit, the feathers used

168 Galen once uses *ἔλασμα* as a general term for probes (*Anat. Proc.* 2.574K = 11.389Gar); see also Aretaeus, *Causes Signs Acute Diseases* 2.6.4 & 2.8.2. Oribasius (*Coll. Med.* 44.20.53 & 56) and Paul (6.78.4, [Leonides]) clearly use the term to designate the shaft (and perhaps also the *puren*) used as a director in treating fistula.

169 For the scoop/spoon see Galen, *Hippocratic Glossary* 19.122K.

170 Künzl (1983a) 90(5), Cologne.

171 For a *μήλη λίθου σαρκοφάγου* in treating leukoma see Aëtius 7.41.42 = Hirschberg, Waugh pp. 64–65, Chp. 41.

172 Gianfrotta (1986) 213–22; Gibbins (1997) 457–9; Künzl (1991b) 192–196 and (1996) 2448–2449; Jackson (2007a) 243–4, Fig. 124, CF 47.37 [Stanway 50's CE].

173 Celsus 7.19.2 & 7; Soranus, *Gyn.* 3.41.5 Ilberg = 3.12.48 BGM; Oribasius, *Coll. Med.* 44.7.14; Paul 6.78.1.

by Hippocratics were pressed into service or, again, the human finger (Galen, *Cmpds. by Place* 12.584K; Aëtius 6.13.27 et passim). With the latter a bladder stone was located and positioned (Celsus, 7.26.2C ff.), or the os uteri adjusted (Aëtius, 16.31.32). More practical was a plain rod of metal, bone, or wood. Surprisingly, few such items show up in instrumentaria (Fig. 84, far rt.; perhaps Fig. 29.23).¹⁷⁴ It would, of course, have been exceptional for probes of natural substances to have been kept around for long; or if kept, to endure. In the case of metal rods the dearth of survivals may be explained in part by the fact that they were so easily procured on the spot that surgeons did not value them enough to make them permanent fixtures in their gear. But it is also obvious that many other articles in a surgeon's kit that were slender and straight and featured at least one end that was pointed or rounded served the purposes detailed above quite well.¹⁷⁵ These categories include the spatulas, ligulas and various spoons discussed below, items that have been recovered in quantity and that are common in virtually every surviving instrumentarium. Based on this factor and on their scant survival, I lean to the view that simple probes of metal were not much in use in the Empire.

A simple probe was referred to by the generic names for probe: μήλη (*mele*) and *specillum*.¹⁷⁶ I begin by listing those references in which the generic names are used without qualification (save for occasional terms like 'fine'/'*tenuis* or 'sharp'/'*acutus*'),¹⁷⁷ for procedures that *could* have been performed by simple probes. The reader will note, however, in progressing through this section that other probe types are often cited for the same operations. Thus we cannot be sure in all, or even in the majority of these instances that the simple *mele* or *specillum* is what the writer had in mind. This is particularly true in the case of Latin authorities, who use few terms for probe other than *specillum*.

174 For metal see Bliquez, Jackson (1994) 160(206). The bone shafts found at Cologne shown by Künzl (1983a) 97(7) are suitable for probing, esp. the second and the third (wound with a snake?) from the right. But it is uncertain they are related to the instruments presented. Galen mentions wooden models (*Anat. Proc.* 2.574K = 11.389Gar).

175 Hippocrates, *Diseases of Women* 8.222.14L compares the smooth tip (*to akron*) of a klyster pipe to that of a *mele*.

176 The λεπτομήλη that appears on *Lists* may be a simple probe: Schoene (1903) 282; Bliquez (1984) 200. Λεπτάριον, also included there, may be its diminutive: Schoene (1903) 282; Bliquez (1984) 196. Rose (ed. 1879) rescued *leptospathium* from *lecto/lepto spacio* at Cassius Felix 32.12 & 36.4 (followed by Proff (1992) 180–182 and Fraisse, the most recent editor). The “rods of lead or tin” to track fistulae at Aëtius 14.55 were probably simple probes. Cornarius' Latin rendering of the Greek original, whatever it was, as *virgulta plumbea aut stannea* suggests as much.

177 Celsus 8.4.2.

mele

Application of Medicament: for nasal growths and polyp (Galen, *Cmpds. by Place* 12.687K); to remove foreign object from nose (Galen, *Cmpds. by Place* 12.689K); to maintain health of eye (Galen, *Cmpds. by Place* 12.729K); for uterine hemorrhage (Soranus, *Gyn.* 3.41.5 Ilberg = 3.12.47–50 BGM); for weak vision, etc. (Alexander of Tralles, *Therap.* 2.45.10); to scarify for sciatica (Oribasius, *Ecl. Med.* 85.2); for menorrhagia (Oribasius, *Ecl. Med.* 147.14); for krite (Oribasius, *Eunap.* 4.17.2); for nasal polyp (Aëtius 6.92.39–45); *collyrium* for eye conditions (Galen, *Maintaining Health* 6.439K; Aëtius 7.100.29, 101.18, & 114.30; Paul 7.16.52); for decay and spreading ulcer (Paul 4.44.1 = Galen, *Cmpds. by Kind* 13.733K).

Cleansing when invested with wool: of exposed and traumatized “nervi” (Aëtius 14.28, Cornarius)

Probing: of vagina (Soranus, *Gyn.* 1.17.2 Ilberg = 1.5.32–34 BGM = Oribasius, *Coll. Med.* 24.31.37); of wound to detect bone fragments in treating fracture of jaw (Paul 6.92.2).

Measuring: depth of vagina for speculum (Aëtius 16.89.10; Paul 6.73.1).

Elevating/ Forcing: to distend mouth of fistula (Paul 6.77.2); for correction of distorted os uteri (Aëtius 16.31.32.); to turn out eyelid for plastic operation (Aëtius 7.71.56 = Hirschberg, Waugh pp. 106–107. Chp. 71).

specillum

Preparation/Application of Medicament: to apply for ophthalmia (Celsus 6.6.1I); to test consistency of medication for night blindness (Celsus 6.6.38); to stir med. for earache (Celsus 6.7.1F); invested with wool and resin to extract foreign object from ear (Celsus 6.7.9); to medicate with wool swab nasal ulcer called ozaina (Celsus 6.8.1B and D); to foment tooth with wool swab (Celsus 6.9.3); to medicate mouth ulcer with wool swab in cases involving children (Celsus 6.15.3); to apply in nose for headache (Scribonius Largus, *Comp.* 10); to apply collyrium (Scribonius Largus, *Comp.* 26 & 36); to medicate caro eminens = ulcerous growth (Scribonius Largus, *Comp.* 240 [Tryphon]).¹⁷⁸

¹⁷⁸ The Elder Pliny refers five times to the *specillum*, all for application of medication, four times for eyes (*Nat. Hist.* 7.183; 29.115; 29.117; 32.75), once for hernia (*Nat. Hist.* 30.136).

Probing/Tracking: for canker/septic ulcer (Celsus 5.26.31C); fistula in flesh and bone (Celsus 5.28.12C–D, 7.4.1B); for enfleshed ear passage (Celsus 7.8.1); for bone fragment in tooth extraction (Celsus 7.12.1D); diseased bone (Celsus 8.2.3, *sp. tenue*); diseased cranium for caries (Celsus 8.3.5–6); for fracture of skull (Celsus 8.4.2–6, *sp. neque nimis tenue neque acutum*).

Director/Block for Scalpel: for fistula (Celsus 5.28.12L, 7.4.1, 7.4.4D); for gangrenous foreskin (Celsus 6.18.3).

Preventing adhesion: inserting *tenue sp.* into urethra to prevent closing before cauterizing ulceration (Celsus 6.18.4).

Olivary Enlargement (πυρήν/baca)

In describing operations involving the probe, the Greek literary sources of the Roman Empire frequently refer to a feature that can be observed on virtually all types of probes. This is at one or both termini an enlargement, which varies in size, being ovular, oblong, or rotund in shape (examples: Figg. 25–26; Fig. 27, far rt.).¹⁷⁹ The Greeks refer to it as *puren* (πυρήν), that is, ‘seed/pit of fruit’, especially of an olive.¹⁸⁰ Occasionally it is connected in texts with, and appears on, needles and knives recovered in excavations.¹⁸¹ In rare instances the expression ‘flat of a probe’ (τὸ πλατὺ τῆς μήλης) sometimes seems the equivalent of ‘*puren* of the probe.’¹⁸²

Surprisingly, Latin authors hardly mention this feature. The fourth century author Theodorus Priscianus refers to a *baca/bacula* or berry on the spatula probe, by which he must mean the *puren*.¹⁸³ Otherwise one has to guess. When, for example, Celsus burns the temporal blood vessels to relieve headache caused by rheumatic eyes with “fine blunt instruments,”¹⁸⁴ he probably refers in a periphrastic way to the *puren*, as both Aëtius and Paul, excerpting earlier sources, apply the heated *puren* for the same condition (see Olivary

179 For distinctions of size, see e.g. Paul 6.90.5: ὅσον τὸ μήκος πυρήνος μεγίστου μήλης.

180 Sometimes one encounters the italicized form πυρίν; see e.g. Galen, *Shoulder Dislocation in Ways not Seen by Hipp.* 18a.376K and *Comm. Hipp. Joints* 18a.478K; Theophilus Protospatharius, *Fabric of Human Body* 2.5 (Greenhill).

181 E.g. Paul 6.21.2, and specimens from Rheims and Bingen: Künzl (1983a) 65(36.31) = Fig. 32 & 82(56.16). See also Aëtius 8.32.8 for the tip of a file being ‘*puren*-like.’

182 Cf. Oribasius, *Ecl. Med.* 100.4 (πλατὺν μήλης πυρήνα: fistula) and *Coll. Med.* 44.20.7, 8, 31 & 32 where the terms πλατὺ and πυρήν seem equated or interchangeable.

183 Cf. *Euporiston* 1.37 & 44. He also refers to the *pyrena meles*: *Ant. Bru.* 4 and *idem*, *Add.* 1.8 (21).

184 *tenuibusque feramentis et retussis* (7.7.15G).

Cauteries under Cauteries). Again, Celsus may mean the *puren* when he cuts into the callus of a fistula, using the ‘end’ (*principium*) of the *specillum* as a block/director (5.28.12L).

The *puren* was so common on probes—on at least one occasion seeming to be the equivalent of *mele* itself (Paul, 6.77.2)—that Galen, in his *Hippocratic Glossary* defines one particular probe as “without a *puren*” (see below, *melotris*).¹⁸⁵ Paul (6.42.1) uses the term πυρηνομήλη in detailing burning of the armpit to contract the area in an effort to prevent dislocation of shoulder, an operation described in the *Hippocratic Corpus*.¹⁸⁶ However, in the actual Hippocratic account the *puren* is not mentioned, nor does it occur elsewhere in the *Corpus*, as preserved. Furthermore, there is no material evidence for its presence before the mid-fourth century BCE, when a slender version appears on spatulas from Olynthus.¹⁸⁷ It may very well be, therefore, that Hippocratic probes did not feature the *puren*.

The *puren* was an extremely versatile element of the probe on which it was mounted. In addition to probing, its applications encompassed grinding, mixing/stirring and applying medicaments, for which it was sometimes wrapped with a piece of wool or heated or moistened.¹⁸⁸ Other functions included measuring (or being used as a unit of measure) and even cauterization. With respect to the latter, the *puren* was particularly well suited to fine, small-scale burns, such as those directed toward elimination of the papillary growths characteristic of ophthalmia.

Though many will be repeated elsewhere in this section, I list here references to the *puren* and its various functions, regardless of the type of probe in question, to demonstrate the frequency of its occurrence in the literature.

Probing/Tracking: cannot penetrate cervix in pregnancy (Galen, *Nat. Fac.* 2.150K [Herophilus], *Diss. Uterus* 2.897K, *Use of Parts* 4.247K, *Causes of Sympt.* 7.166K, *Aff. Parts* 8.446K; Aëtius 16.1.58; Theophilus Protospatharius, *Fabric of Human Body* 2.5 [Greenhill]; Theophilus Prot., Damascius and Stephanus, *Comm. Hipp. Aph.* 2.477.

185 19.85K: ἀπυρομήλη· τῇ πυρήνα μὴ ἐχούσῃ, τουτέστι τῇ μηλοτριδί. Milne (p. 54) maintains ἀπυρηνομήλη occurred as well, but gives no source, either among the mss. of Galen or of any other author. Yet ἀπυρηνομήλη is most likely the form Galen wrote at 19.85K. If ἀπυρομήλη/ἀπυρηνομήλη occurred in any lost text in the *Hippocratic Corpus*, it was surely a later one.

186 There are many variants on this text but πυρήν figures in all of them, which is the point.

187 Robinson (1941) pt. 10, 349–354(1668–70, 1687, 1692) and Pls. CXI, CXII.

188 See, e.g., Galen, *Cmpds. by Place* 12.689, 739, 828K.

23–28); failure to penetrate anus a deadly sign in ileus (Aëtius 9.28.22); testing peritoneum (Oribasius, *Coll. Med.* 50.48.3).

Bleeding: inducing nasal bleeding (Paul 6.40.6).

Measuring or as a Unit of Measure: from iris to small canthus in depression of cataract (Paul 6.21.2 [Galen]); length of vagina for proper speculum (Paul, 6.73.1); distance between drill perforations in trepanation prior to application of chisels (Oribasius, *Coll. Med.* 46.11.15; Paul 6.90.5).

Mixing and Application of Medicaments:

Escharotics/applications for ulcers, etc.: Galen, *Meth. Healing* 10.202 & 889K = J-H 1.308–309 & 3.340–341, *Simples* 11.757 & 12.218K, *Cmpds. by Kind* 13.850 [Asclepiades], 851 [Eunomus] & 857K [Diodorus]; Oribasius, *Ecl. Med.* 89.9; *Syn.* 3.110.

Applications for eyes: Galen, *Treat. by Venesection*. 11.300K, *Simples* 12.196K (= Oribasius, *Eunap.* 2.1.lambd.12), *Cmpds. by Place* 12.732K; Pseudo-Galen, *Drugs Easily Procured* 14.343K (= Oribasius, *Eunap.*, 4.21.1); Aëtius Book 7: 13.20, 21.4, 26.21, 32.86, 42.4, 45.32, 69.17, 79.52, 84.3, 101.99, & 114.30; Oribasius, *Coll. Med.* 10.23.22–23; Paul 3.22. 4; *Hippiat. Ex. Lugd.* 132.7.

Nasal applications, especially for nasal polyp and ozaina: Galen, *Cmpds. by Place* 12.681 [Asclepiades], 685 [Philoxenus], 689–690K; Aëtius 6.52.11; 6.92.7, & 6.97.26; for hysterical choking, Aëtius 16.67.94.

Applications for growths on face/chin/mouth: Galen, *Cmpds. by Place* 12.828 [Crito], 847 [Archigenes], & 953K [Andromachus]; Oribasius, *Eunap.* 4.52.2.

Additional applications: for glandular ulcer (Oribasius, *Coll. Med.* 44.13.20–21); to introduce pledget in treating hydrocele (Paul 6.62.3); for penile carbuncle (Aëtius 14.58, Cornarius, *cum specilli nucleo*).

Director/Block: for scalpel for fistula (Aëtius 14.55, Cornarius, & 16.40.22 [Leonides]; Oribasius, *Coll. Med.* 44.20.7–9, 31–32, 53, 55 [Antyllus and Heliodorus], *Ecl. Med.* 100.4; Paul 6.78.4 [Leonides]).

Elevating/Forcing: anterior column of fornix (Galen, *Anat. Proc.* 2.724K = 11.571Gar); aneurysm (Oribasius, *Coll. Med.* 45.24.4); scrotum in operating for hydrocele (Paul

6.62.3); depressing intestine in treatment of bubonocoele (Paul 6.66.1); repositioning inner parts of fractured nose (Paul 6.91.1); expanding fistula (Paul 6.77.2).

Heating/Cauterization: applying heated wax to aching tooth (Galen, *Cmpds. by Place* 12.863K; Pseudo-Galen, *Drugs Easily Procured* 14.356K; Aëtius 8.35.49); krite/posthia (Aëtius 7.84.3 = Hirschberg, Waugh pp. 120–121. Chp. 84); armpit, as in Hippocrates (Paul 6.42.1 with πυρηνομήλη, if text is sound).

For the references to καυτήρες/καυτήρια πυρηνοειδεῖς/πυρηνοειδή, see Olivary Cauteries.

Probe Terminating in Two Olivary Enlargements (dipyrene)

Slender shafts of copper alloy featuring a *puren* at each end have been recovered both at sites (Pompeii) and in graves (Fig. 3, middle row, 11th from left; Fig. 29.36).¹⁸⁹

The name in the medical literature that best matches this instrument is διπύρηνον (*dipurenon*) or ‘instrument with double *puren*’, now often transliterated *dipyrene*. Galen cites the tool six times in *Anatomical Procedures* where he uses it as a probe in his explorations, classifying it as an *elasma* (2.574K = 11.389Gar),¹⁹⁰ and once referring to it as “fine and long” (2.711K = 11.555Gar, λεπτόν, προμήκης).

Chronologically, the archaeological finds are roughly in line with the literary references, extending from the first to the fifth century. Attestations are found in Soranus, Galen, Oribasius, and Paul. The instrument appears as well on *Lists*.¹⁹¹

Only copper alloy specimens survive, but Galen attests wooden models and Paul flexible types of tin and very fine types of copper.¹⁹²

Several surviving *dipyrenes* feature one or more eyes bored through the *puren*.¹⁹³

189 For those recovered in Pompeii, see Bliquez, Jackson (1994) 161–162 (209–213), though none can be placed in a surgical context. For those recovered in surgeons graves see Künzl (1983a) 48 (16.36), 106 (85.7) and, probably, Künzl (2002b) 36 & Taf. 35 (B92–94); Jackson (1986) 128 (27).

190 ονομάζειν δ' ἔθος ἐστὶ τοῖς ἀνατομικοῖς ἐλάσματα πάντα κοινῇ προσηγορίᾳ τὰ τοιαῦτα... διπύρηνον...

191 Schoene (1903) 281; Bliquez (1984) 199; Fischer (1987) 34 (9).

192 Cf. Paul (6.77.2), probing fistula διπύρηνω εὐκαμπεῖ τοιαῦτα δὲ εἰσι τὰ κασσιτέρεινα καὶ τῶν χαλκῶν τὰ λεπτότατα; Galen, *Anat. Proc.* 2.574K = 11.389Gar: ... διπύρηνον, μῆλωτίδας, οἷς ὁμοία δυνατόν ἐστι κατασκευάζειν ἐκ ξύλου πυκνοῦ...

193 Künzl (2002b) 36 & Taf. 35 (B92).

The applications of the *dipyrene* detailed in the literature include:

Probing: opening to salivary glands (Oribasius, *Coll. Med.* 24.8.4); crooked fistula (Paul 6.77.2); prolapse of the womb (Soranus, *Gyn.* 4.36.3 Ilberg = 4.6.41–42 BGM); fallopian tubes, ureter of animals (Galen, *Semen* 4.595K; *Anat. Proc.* 2.581K = 11.397Gar).¹⁹⁴

Introducing: knotted cord through nose for polyp (Paul 6.25.3); cord through anal fistula in Hippocratic manner = apolinos (Paul 6.78.3).

As a director: in exploring the brain (Galen, *Anat. Proc.* 2.711K = 11.555Gar).

Levering, Elevating: varicose veins (Oribasius, *Coll. Med.* 45.18.25–26); idem (Pseudo-Galen, *Intro. or Physician* 14.790K = Petit 19.15).

Cauterization: to prevent re-growth of offending eyelashes (Paul 6.13.1).

Amphimele/Amphimelon

Ivan Garofalo, the most recent editor of Galen's *Anatomical Procedures* emends/ prefers *amphimele* and *amphimelon* in place of *amphismile* and *amphismilon*, the terms entered in Kühn's edition (2.574 & 581K). The latter pair would seem to designate a knife sharp on both sides of the blade, the former pair a probe. It is tempting to think *amphimele* and *amphimelon* are the correct readings, because in both passages these *amphi*- terms occur in sequences of names involving probes.¹⁹⁵ Furthermore, *Anat. Proc.* 581 seems to equate its *amphi*- term with *dipurenon* (. . . εἴτε ἀμφί—εἴτε διπύρηνον ὀνομάζειν ἐθέλεις . . .). This nicely fits *amphimelon*, as opposed to the vulgate *amphismilon*, since *amphimelon*, like *dipurenon*, should mean a probe with an olivary enlargement on both ends.¹⁹⁶

Unfortunately, it is just possible that Galen wrote ἀμφισμίλας at *Anat. Proc.* 574K (see s.v., above under Cutting and Puncturing Instruments).

194 Künzl (2002b) 4 and (1983b) 489 has observed that, as one finds the *dipyrene* in the company of urological tools like lithotomes, it may also have often served as a urological sound.

195 If we follow Garofalo (11 389), we read μήλας σπαθομήλας ἀμφιμήλας διπύρηνον μηλωτίδας . . . and (11 397) εἴτε ἀμφίμηλον εἴτε διπύρηνον ὀνομάζειν ἐθέλεις, εἰ δέ τι λεπτότερον δέη, καὶ τὴν μηλωτίδα . . .

196 Milne (1907) 57 accepted *amphismilon* in Kuhn's text but thought the term was an alternate name for *dipurenon* anyway.

There is one indisputable reference, Oribasius, *Coll. Med.* 7.14.5 [Antyllus]. There an ἀμφίμηλον (= *dipyrene*) is used to raise a blood vessel in arteriotomy.

Eyed Probe

As we know, one method employed by Hippocratics for dealing with an anal fistula was to pass through it a linen cord, tie its ends together, then tighten the cord at intervals until the fistulous canal was worn through and lay completely open. The cord was introduced with a flexible probe perforated at one end, like a needle. This method, called by later Greek authorities ‘apolinosis’, appears regularly in surgical texts from Celsus (7.4.4) to Leon Iatrosophistes (*Conspectus Medicinae* 5.19.2).¹⁹⁷ Perforated probe types, like the *dipyrenes* treated above, have occasionally been recovered;¹⁹⁸ but none can be associated with surgery and do not, anyhow, appear suitable for apolinosis, for which the Hippocratics and, later, Paul recommended tin models for their flexibility.¹⁹⁹

*Spatula Probe*²⁰⁰

A multi-purpose type of spatula is a frequent find on archaeological sites and abounds in surgical kits taken from graves.²⁰¹ When utilized by physicians/pharmacists it is referred to as *spathomele* or ‘spatula probe’ (σπαθομήλη).²⁰² In keeping with its name, the *spathomele* features a spatula at one end of its shaft and, as is sometimes specifically noted in the literature, a *puren* at the other.²⁰³

197 Paul 6.78.3.

198 Bliquez, Jackson (1994) 162(213).

199 Paul 6.78.3 follows Hippocrates, though without mentioning tin. But this is likely simply understood, as Paul requires a tin probe for exploring fistula in the previous chapter (6.77.2).

200 Only a few of the spatulas used for purposes of illustration in this section were recovered with surgical tools. For the sake of convenience I have simply used images that I had to hand to show the various types, most of which are paralleled in actual instrumentaria. Those that are not may turn up in future discoveries.

201 For Herculaneum-Pompeii see Bliquez, Jackson (1994) 135–143(107–138); for graves see Künzl (1983a) 47(15.11); 58(26.2); 65(35.23); 77(51.17 & 18); 83(57.11).

202 In the manuscript tradition of Galen we find the itacising variant σπαθομίλη (*Anat. Proc.* 2.574K = 11.389Gar who normalizes; *Shoulder Dislocation in Ways not Seen by Hipp.* 18a.376K; *Comm. Hipp. Joints* 18a.478K). Marcellus Empiricus, *De Med.* 14.44 stirs a mixture *tudicula vel spathomeli aeris rubri*. *Tudicula* (cf. *tudiculare* ‘to stir’) must be more or less the equivalent of *spathomele*.

203 Galen calls specific attention to the *puren* at *Anat. Proc.* 2.711K = 11.555Gar and at *Shoulder Dislocation in Ways not Seen by Hipp.* 18a.376K.

Spathomele/*spatomelle* appear in late Latin sources;²⁰⁴ but, as such references are exceedingly rare, we must assume this instrument was commonly designated in Latin by *specillum*, the blanket term used for all probes. A pretty clear indication is Scribonius Largus' directive to apply an abundant amount of ointment "with the flat of a probe" (*specilli latitudine*) in treating hemorrhoids (*Comp.* 227). In Greek the spatula terminus is called *platos*, *platu*, *platu meros* and *elasma* (πλάτος, πλατὺ, πλατὺ μέρος, ἔλασμα).²⁰⁵ The earliest recovered examples go back to the 2nd century BCE.²⁰⁶

The spatula on survivals may be ovular, sometimes flaring at its base to create a fish-like form (Fig. 3, 3rd–5th from left; Fig. 25, specimens to the rt.; Fig. 84, 3rd from rt.); or it may be roughly rectangular, often with pointed projections where it joins the shaft, creating a base resembling the tail of a swallow (Fig. 25, specimens to left).²⁰⁷ The latter shape can be traced from the 2nd century BCE into the 1st of our era; the former appears for certain by the 1st century BCE and has displaced the swallowtail form by 79 CE when the oval spatula is dominant in the Vesuvian cities.²⁰⁸ Less frequently occurring types resemble lancets and other forms (Fig. 2, 3rd & 4th from left; Figg. 26–27).²⁰⁹ Shafts in the main swell on the spatula side and often feature striation. Otherwise, in contrast to the spoon probes (see below), which they resemble, they seldom are decorated with raised rings; also extremely rare are examples in which the shaft is wound around with an inlay of silver as decoration.²¹⁰ As with the *dipyrene*, while we have so far only recovered specimens of copper alloy, Galen includes the *spathomele* among instruments that could be rendered of wood (*Anat. Proc.* 574K = II.389Gar). In the veterinary *Mulomedicina Chironis* 662 a type rendered in bone is mentioned (*spatulam osseam*).

204 Theodorus Priscianus, *Euporiston* 1.37, 44, and 78 with Rose's app. crit. Cf. also *Mulomedicina Chironis* 667 & 854.

205 Galen, *Anat. Proc.* 2.724K = II.571Gar (τὸ πλατὺ μέρος... σπ.), Aëtius 16.79.6 (τῷ πλατέι τῆς σπ.); Oribasius, *Coll. Med.* 44.8.2 & 44.20.7 (τὸ πλατὺ μήλῃς) and *Coll. Med.* 44.8.2 & 4: πλατὺ μήλῃς... τὸ ἔλασμα τῆς μήλῃς). Cf. Galen, *Anat. Proc.* 2.686K = II.525Gar: σπαθομήλην πλατεῖαν.

206 Künzl (1991b) 191–192. Primitive spatula types existed much earlier; for example, those recovered in the archaic sanctuary at Tegea. See Dugas (1921) 387–338 with Fig. 40(171–173).

207 Galen, *Hippocratic Glossary* 19.141K focuses on the ovular type: στρογγύλον μήλην τὴν σπαθομήλην.

208 Künzl (1991b) 192–196; for Pompeii, see Bliquez, Jackson (1994) 135–140(107–128).

209 Bliquez, Jackson (1994) 46, 140–141(129–133).

210 Bliquez, Jackson (1994) 46. The specimen from Italy shown on Fig. 3, 3rd from left, features unusually complex décor, best illustrated by Jackson's drawing (1986) 129(4.33).

To judge by the number of survivals all over the Roman world, the *spathomele* was a common household article, used mainly for cosmetic and other domestic purposes. In the hands of a physician its *puren* was well suited to grinding materia medica, and both *puren* and spatula were effective in mixing and applying them. Of course, both *puren* and spatula made splendid probes, the latter also serving as a dissector, and either could be heated for cauterization. We also hear of the shaft being positioned as a director over which a scalpel might be drawn, in treatment of fistula for example, and of the spatula as a guard for vulnerable areas needing to be protected against scalpel, chisel or drill, particularly during operations on bone (see below and Bone and Tooth Instruments, s.v. Guard/Protector (*Meningophulax*)).

The common name *mele* could, of course, just as well designate the spatula probe as other probe types. But from Galen through to *Lists* the more precise term *spathomele* (σπαθομήλη) is found.²¹¹ I first will list all references to the *spathomele* by category of use and then proceed to discuss other names that may designate the *spathomele*. I include among them references to the *mele* when it is likely that a *spathomele* is meant.

Preparation and Application of Medicaments: mixing drugs on flat of hand for lichen (Galen, *Cmpds. by Place* 12.467K); mixing a pessary on flat of hand for inflammation of uterus (Aëtius 16.79.6); for mentagra (Galen, *Cmpds. by Place* 12.840K [Pamphilus]); plaster w/ chalcitis for arthritis and gout (Galen, *Cmpds. by Kind* 13.381K); Pamphilus' med. for mentagra (Aëtius 8.16.124–5); lycium and honey for carbuncle (Theodorus Priscianus, *Eup.* 1.78); for impetigines = conjunctivitis? (Theodorus Priscianus, *Eup.* 1.37).

Cleansing: clots of nosebleed (Theodorus Priscianus *Eup.* 1.44).

Probing: ventricles of brain (Galen, *Anat. Proc.* 2.728K = 11.577Gar); cavity of meninx (Galen, *Anat. Proc.* 2.711K = 11.555Gar); *puren* of *sp.* cannot penetrate torcular Herophili (Galen, *Anat. Proc.* 2.712K = 11.557Gar); fallopian tubes, ureter of animals (Galen, *Semen* 4.595K).

Levering/Pressuring/Supporting: undergird rib of animal in dissection (Galen, *Anat. Proc.* 2.686K = 11.525Gar); raise anterior column of brain's fornix (Galen, *Anat. Proc.* 2.724K = 11.571Gar); lever/dissector for flaps in hupospathismos (Pseudo-Galen, *Intro. or Physician* 14.784K = Petit 19.8); tongue depressor for tonsillitis (Aëtius 8.48.69, [Philumenus]; Oribasius, *Coll. Med.* 44.11.13); reshaping

211 For *Lists* see Schoene (1903) 283; Bliquez (1984) 202; Fischer (1987) 34(7).

broken nose (Oribasius, *Coll. Med.* 46.2.5); suspending hide in accessing pulmunculus (*Mulomedicina Chironis* 667).

I also find a reference in the veterinary literature to dispersal of (as opposed to scraping away) secretion from scarification (*Hippiat. Paris.* 111.6 for παραπλήσματα = a kind of dropsy?).

References to spathomele as mele

As observed above, the spatula on a *spathomele* was designated by the terms *elasma*, *platu* and *platos*.²¹² When, therefore, those terms occur in conjunction with *mele*, the general name for probes, one reasonably concludes that in these situations *mele* = *spathomele*. Galen too points us in this direction when in his *Hippocratic Glossary* he equates the Hippocratic μήλη πλατείη with τῇ σπαθομήλῃ (19.122K). At the same time he confuses the issue in the same work (19.122K) when he defines the Hippocratic μήλης τῶ πλατεί (“with the flat of a mele”) as τῶ κυαθίσκῳ τῆς ὀφθαλμικῆς μήλης (“with the spoon/scoop of an *ophthalmic mele*”). In situations like these we are reminded how fluid the terminology can be. None-the-less, to associate πλατός μήλης with a spoon probe is surely exceptional; one might say the exception that proves the rule. Based on their context, I am confident that a *spathomele* lies behind the following references to “the flat of a *mele*.”

Preparation and Application of Medicaments: to anus for piles *specilli latitudine* (Scribonius Largus, *Comp.* 227).

Probing: wider fistula (Oribasius, *Coll. Med.* 44.19.2–3 [Antyllus]).

Dissecting/cutting: accessing goiter (Galen, *Aff. Parts* 8.55K); bone fragment from meninx in skull fracture (Oribasius, *Coll. Med.* 46.15.5).

Director/Block: trepanning rib (Oribasius, *Coll. Med.* 44.8.2); opening fistula (Oribasius, *Coll. Med.* 44.20.8).

Levering/Pressuring: carbuncle till it blackens (Galen, *Cmpds. by Kind* 13.855K); prying up finger ring (Oribasius, *Coll. Med.* 47.17.5; Aëtius 14.81, Cornarius).

Cauterization: umbilicus of newborn (Soranus, *Gyn.* 2.11.4 Ilberg = 2.6.25–27 BGM).

²¹² Once I find σπάθην μήλης ἐμβάλων for probing a fistula in the late veterinary *Hippiatrica Cantabrig.* 100.8.10.

Cognate Terms

The literature also provides kindred appellations such as *spathe* (σπάθη; Latin *spatha*) and the Greek diminutive *spathion* (σπαθίον).²¹³ These muddy the water somewhat. On the one hand, *spathion* is categorized—if not equated—with *spathomele* by Galen.²¹⁴ This fits with the functions associated with *spathe/spathion*, primarily mixing and stirring—a wooden model once acting as a guard²¹⁵—, functions that are in keeping with those of the *spathomele*. At the same time Galen makes it clear that a *spathe* or *spathion* used to prepare medications might be designed for use in other trades, like perfume manufacture (*Cmpds. by Kind* 13.1044K, ἐν σπάθῃ μυρεψικῇ). If we shift to surviving spatulas, we find models that, unlike the the *spathomele*, feature flat, as opposed to rounded shafts, and that fail to mount the *puren*; for example the crude specimens in the Naples Museum.²¹⁶ None of these latter types can be associated with a surgical instrumentarium. As the literature frequently refers to wooden and sometimes iron models, which would have been biodegradable, this may be the reason for their absence so far. In sum, behind references in the literature to the *spathe/spathion* found useful by physician and pharmacists, there clearly lie spatulas of other materials and likely of different shapes than the *spathomele* of copper alloy. This type is treated under Vessels/Containers, s.v. Instruments for Stirring.

Double Spatula

In contrast to the crude spatulas just cited in the Naples Museum, there are also to be found there three well-made double spatulas mounted on a compressed shaft (Fig. 2, bottom row 6th & 7th from left; Fig. 28).²¹⁷ The find spots of these are recorded as Pompeii in the *Inventarii*; but no more specific information is given to connect them with a surgical site. However, as close parallels are found in the Bingen, Colophon and Rimini instrumentaria and now among the instruments at Alliano, these pieces were likely made and used as surgical tools.²¹⁸ Unfortunately, we are on shakier ground when we speculate on their

213 Pliny, *Nat. Hist.* 23.139 for *spatha*. Likewise the verb σπαθίζω occurs frequently in Greek authors of the Empire.

214 *Ant. Proc.* 2.724K: τὸ πλατὺ μέρος τῶν καλουμένων σπαθίων ἢ καὶ σπαθομήλης.

215 See Guard/Protector (*Meningophulax*) under Bone and Tooth Instruments.

216 Bliquez, Jackson (1994) 144(143–144).

217 Bliquez, Jackson (1994) 143(139, 141 & 142).

218 For Bingen and Colophon see respectively Künzl (1983a) 83 (57.10) and Caton (1914) 117(XII). For Rimini (184476) I depend on personal communication from Ralph Jackson. For Alliano see Baykan (2012) cover and 126(221). There is yet another badly preserved specimen in the Robinson Collection (Oxford, Mississippi): see Bliquez (1988) 50(47), 74(47). It too was likely included in a surgical instrumentarium.

name and purpose, as there is no clear reference to the type in the literature. Scholars have connected them with application of plaster casts and with levering, as of bone.²¹⁹ Both are possible; but obviously these tools had a name and *spathe* is the most likely candidate. If so, they were intended for those functions recorded in the literature for the *spathe*. For another possible function see next entry.

Tongue Depressor

Oribasius, Aëtius and Paul record a device for depressing the tongue, Oribasius (*Coll. Med.* 44.11.13 [Heliiodorus?]) and Aëtius (8.48.70 [Philumenus]) in lancing quinsy and Paul in tonsillectomy and excision of diseased uvula (6.30.2 & 31.2). All refer to it as γλωσσοκάτοχον (*glossokatochon*). In Paul the *glossokatochon* is manipulated by an assistant (δι' ὑπηρέτου). The term finds its way onto *Lists*.²²⁰

While none of these late authorities describes the shape of the tool, Oribasius and Aëtius state that the spatula probe could also be used (τὴν γλῶτταν σπαθομήλῃ καταστεῖλαι ἢ γλωσσοκατόχῳ). So, the *glossokatochon* must have been of similar appearance if it was not actually just a spatula, perhaps a particularly broad model like the large double spatulas in the Naples Museum (Fig. 28).

Koparion and Hudrokelikon Koparion

The Greek term κοπάριον (*koparion*) is restricted to Paul save, perhaps, for one instance in Aëtius.²²¹ Paul several times refers to its *puren* or olivary enlargement (6.78.4), the only secure information as to its features. This accords well with the name *koparion*, which appears related to the stem κοπ—meaning ‘to cut, pound, bray’, as in the preparation of medications, a function of the *puren*.²²² One inclines to think that a spatula occupied the opposite terminus of the instrument; for, Paul employs *koparion* in contexts where we find *spathomele* (or alternate names for it) in other authors. Furthermore, his use of the *koparion* in dissecting, and levering (as well as a putative reference in Aëtius to curetting) suggests a flat terminal surface like a spatula. Likewise the

219 Milne (1907) 79; Tabanelli (1956) xxxi.

220 Schoene (1903) 281; Bliquez (1984) 198; Fischer (1987) 38(54). I have previously entertained the idea that the term βούγλωσσον, which occurs on *Lists*, might be another name for the tongue depressor or a cautery: Bliquez (1984) 195. I now think this unlikely. The term never designates anything else but a plant in its frequent mentionings elsewhere.

221 7.92.24 (Severus). The text is bracketed by Olivieri because the *kop.* is used for curetting bone, although the topic is arteriotomy; thus *kop.* looks intrusive. This does not, however, mean that a *koparion* could not be used for bone work.

222 Cf. Alexander of Aphrodisias, *Prob.* 1.67.1–8.

koparion serves Paul as a director/block in opening a fistula (6.78.4), a function recorded elsewhere for the shaft of a spatula probe. On the other hand, when he wishes to ligate a fistula in the Hippocratic manner (*apolinosi*), Paul requires an eyed *koparion* or *dipyrene*: “[Hippocrates tells us] to draw a five ply cord of raw linen through the fistula with a perforated *koparion* or a *dipyrene*.”²²³ We have seen that eyes are associated with the *dipyrene*, which leaves open the possibility that Paul equates *koparion* and *dipyrene* in this passage. In general it seems best to allow the term *koparion* to extend to several probe types. A full list of its uses (all but one in Paul) includes:

Dissecting, Curetting: to lay bare peritoneum in enterocoele (6.65.2; but see below, *hudrokelikon kop.*); scraping of bone (Aëtius 7.92.24 [Severus]).

Probing: straight fistula, as opposed to *dipyrene* for crooked fistula (6.77.2).

Director/Block: as director for scalpel incising blind fistula (6.78.2).

Introducing: Hippocratic ligature in fistula with *dipyrene* or eyed *kop.* (6.78.3).

Levering: prying up pterygium about the nails with a fine (*λεπτὸν*) *koparion* (6.85.2; cf. 3.81.4 where however the term *lepton* is not used); to force open blind fistula with its ‘terminus’ (τῇ του κοπαρίου ἀρχῇ, 6.78.2).

On two occasions Paul deploys an *hudrokelikon koparion* (ὕδροκελικὸν κοπάριον), once to reach the tunica vaginalis in operating for hydrocele (6.62.2) and once in dissecting out a varix (6.82.1). In the account of the operation for varicose veins, Paul says:

When we have retracted the lips of the incision with hooks, and dissected the tissues with the angled/curved/bent *koparia* for hydrocele (τοῖς ὑδροκελικοῖς ἐπικαμπέσι κοπαρίοις) . . . and have raised the varix with a blunt retractor (τυφλανκίστρῳ) . . . we divide the varix through the middle with a phlebotome and empty it out.²²⁴

223 6.78.3: λίνον πεντάπλοκον ὡμὸν διὰ τετρημένου κοπαρίου ἢ διπυρήνου διαγαγεῖν διὰ τῆς σύριγγος. Paul must be citing [Hippocrates] *Fistulas* 4. Note that Paul has substituted *koparion* for *mele*, the term actually used there. Neither did *dipyrene* occur in the Hippocratic original.

224 ἀγκίστροις δὲ τὰ χεῖλη τῆς τομῆς διατείναντες καὶ τοῖς ὑδροκελικοῖς ἐπικαμέσι κοπαρίοις τοὺς ὑμένας ὑποδείραντες . . . τυφλανκίστρῳ τε τὸ ἀγγεῖον μετεωρίσαντες . . . διελόντες φλεβοτόμῳ κατὰ μέσου τὴν φλέβα κενώσομεν . . .

Milne took this *hudrokelikon koparion* to be the large blunt retractor of the type now taken as the *tuphlankistron* (see Retractors and Hooks, s.v. Blunt or Blind Hook).²²⁵ In favor of this view is 6.62.4, the operation for hydrocele, where Paul seems to equate the two when he exposes the tunica vaginalis by separating the darti “with a *koparion* or *tuphlankistron*” (κοπαρίῳ δὲ ἢ τυφλαγκίστρῳ).²²⁶ Against this equation is the fact that in Paul’s intervention for varicose veins, he deploys the *tuphlankistron* to raise the varix *after* dissection with the *hudrokelikon koparion*. This would seem to distinguish the instruments. As *hudrokelikon koparion* is shortened to simple *koparion* in 6.62.4 we should leave open the possibility that we are again dealing with no more than a spatula probe, but perhaps one with its spatula angled off to the side, as may have been the case in instances where a spatula was employed as a guard (see Bone and Tooth Instruments, s.v. Guard/Protector, *Meningophulax*). Note that at least one spatula of this type may belong to a surgical instrumentarium.²²⁷

Hupaleiptron (ὑπάλειπτρον)

As we have seen, the term *hupaleiptron* emerges in the *Hippocratic Corpus* where it is cited in connection with gynecological problems, broken nose and dislocated shoulder. Of Imperial authors Galen (followed by Oribasius and Paul)²²⁸ deploys the *hupaleiptron* for cleansing a wound with a swab (*Meth. Healing* 10.404K = J-H 2.146–147) and for medicating the eyes (*Hippocratic Glossary* 19.148K).

While it is clear that the *hupaleiptron* was for Hippocratics a probe, it is unclear precisely what form it assumed. This, I believe, led Galen to apply the name to a variety of probe types with a *puren*. For further discussion see (see above: Hippocratic Surgeries and Surgical Tools, s.v. Probes).

Spoon Probes (Including Ear Probes and Ligulae)²²⁹

This is a complex category in which the same name may be applied to several different spoon types or several names to the same type. As stated in the Introduction, this is not unusual for surgical tools, but it is particularly characteristic of the various spoon probes employed by Roman physicians and pharmacists.

²²⁵ (1907) 85.

²²⁶ ... κοπαρίῳ δὲ ἢ τυφλανκίστρῳ τοὺς ὑμένας διαδέρροντες τῷ μαχαιρωτῷ τούτους καυτήρι ὥσπερ διατέμνοντες καύσωμεν ...

²²⁷ Bliquez (1988) 34(6). There is a similarly bent dissector on a scalpel from Dunaujvaros. Cf. Künzl (1983a) 116(91).

²²⁸ Oribasius, *Syn.* 7.22.15, *Eunap.* 3.38.15; Paul 4.54.5.

²²⁹ For an earlier treatment of this class of probes see Bliquez (2003).

We may begin with a type of tool regularly featured in Imperial instrumentaria (Fig. 2, bottom row, 3rd, 8th, 11th–12th from rt.; Fig. 3, middle row 7th from left; Fig. 20, 4th–6th from rt.).²³⁰ It consists of a scoop or spoon mounted on a long shaft, the entire ensemble measuring between ca. 11 and 17 cm in length. The bowl of this instrument may be ovular in shape or rather like an elongated triangle; it may be round or angular in section and varies in depth. The shaft on which it is mounted is quite often striated lengthwise and virtually always decorated with rings of different shape arranged in different ways at the point where the shaft passes into the bowl. Sometimes, to heighten the aesthetic effect, the shaft is threaded and inlaid with a spiral silver wire.²³¹ Invariably the shaft terminates in the familiar *puren*.

My predecessor Milne associated the type with no ancient name but applied one of his own invention: ‘cyathiscomele.’²³² The name has stuck and is used by scholars today along with its English and German translations, ‘spoon probe’ and ‘Löffelsonde.’ Obviously so common an article had a name. In fact it went by a number of names, the principle one applied by Greek authorities being *mele* (μήλη), the generic term for ‘probe.’ (For Latin terms see below.) In addition I believe that *melotis* (μηλωτρίς), and *melotris* (μηλωτρίς) were sometimes applied, and, though seldom, also *exotis* (ἐξωτρίς) and *otogluphis* (ὀτογλυφίς). For the sake of convenience, I will continue to use the name ‘cyathiscomele’ when it is necessary to distinguish this particular spoon probe from others bearing these names.

Milne limited the functions of his ‘cyathiscomele’ to use “occasionally as a sound, but mainly to mix, measure and apply medicaments”, conceding in addition that some specimens might have been curettes. However, once the names *mele*, *melotis* and *melotris* are associated with this instrument, its functions can be expanded and its usefulness as a surgical instrument more fully understood.

230 I should say at the outset that this article was in common use domestically as well as professionally. Obviously, we are here only concerned with its medical applications. For its presence in surgical instrumentaria, see e.g. Künzl (1983a) 47(15.13–15), 72(46.4), 89(67.8), 90(68.8), 91(69.2–3), 94(75.14), 104(83.6), 106(85.5), 113(88.3), 115(90.3); Jackson (1986) 128–129(30). For its presence in public baths, see Künzl (1986) 497 (Weissenburg). For variety of decor and shapes, see Bliquez, Jackson (1994) 145–154(145–184).

231 Bliquez, Jackson (1994) 145(146).

232 (1907) 61–63. Milne invented the term because, as the following discussion will show, his adherence to Galen's views precluded application of any transmitted name to this particular spoon.

As previously noted, many literary passages in which the *mele* is mentioned, add features such as *to platy* (τὸ πλατύ) or *to elasma* (τὸ ἔλασμα), ‘the broad thing’ or ‘the plate’²³³ to designate, for example, the spatula on the *spathomele*.²³⁴ However, we also hear often of models that mount a spoon or scoop, called in Greek *kuathiskos* (κυαθίσκος). To cite one example, Galen (excerpted by Aëtius) uses the *kuathiskos* to apply medicament to a diseased uvula: “let the application be made by a spoon (*kochliarion*) or by a *kuathiskos* of a *mele*.”²³⁵ The form *kuathiskos* is a diminutive of *kuathos*/κύθος (ladle/spoon); so the spoon/scoop designated by *kuathiskos* should be relatively small. This is in keeping with the type of spoon mounted on the ‘cyathiscomele’, which ordinarily measures between ca. three and five cm in length.²³⁶

In addition to the application of medicament, as in Galen, the functions of the *kuathiskos* of the *mele* vary considerably. Galen and Alexander of Tralles use it as a curette in scraping away ulcers of the eyelid, consequent on conjunctivitis, Galen remarking that he prefers a scoop narrower at the end (αὐτῷ τῷ κυαθίσκῳ τῆς μήλης στενὸν ἐχούσης, οὐκ εὐρὺ τὸ πέρας).²³⁷ Paul finds the back of the *kuathiskos* handy for everting and supporting the eyelid while operating for ectropion (6.12.1); likewise, he regulates blood flow from the jugular vein in performing venesection with the back of the *kuathiskos* (6.40.6). In his *Hippocratic Glossary* Galen equates an Hippocratic probe with the *kuathiskos* of an ophthalmic *mele* used by contemporaries for eyework.²³⁸ I suspect this ophthalmic probe is the same as, or a minor variant of, the instrument just cited as useful for eyes by Alexander, Paul, and Galen himself (see below, Curette for Eyelids). Finally Paul files down uneven teeth with the *kuathiskos* of the *mele* as well as with a scraper or a file.²³⁹

233 Cf. e.g. Oribasius, *Coll. Med.* 44.8.2.

234 Though not necessarily always. I find one instance in which *to platu* means spoon, another example how fluid the nomenclature of surgical instruments can be: see Galen, *Hippocratic Glossary* 19.122K: μήλης τῷ πλατέϊ· τῷ κυαθίσκῳ τῆς ὀφθαλμικῆς μήλης.

235 8.43.31: ἐμβεβλήσθω δὲ κοχλιαρίῳ ἢ κυαθίσκῳ μήλης τὸ προσαγόμενον.

236 I am inclined to think that, when they do not refer to standards of measurement (as they do not, for example, at Galen, *Cmpds. by Place* 12.944 & 962K; Oribasius, *Syn.* 3.176.3; *Eunap.* 4.69.5), unqualified references to *kuathiskos* and *kochliarion* may mean the ‘cyathiscomele’ as readily as other types of spoons/scoops. But such references are rare, which discourages me from adding these names to those of concern here.

237 Galen, *Comm. Hipp. Epid.* 6, 17a.902K; Alexander of Tralles, *Therap.* 2.49.20 (trachoma).

238 19.122K: μήλης τῷ πλατέϊ· τῷ κυαθίσκῳ τῆς ὀφθαλμικῆς μήλης.

239 τῷ κυαθίσκῳ τῆς μήλης ἢ ξυστηρίῳ ἢ τῷ ῥιναρίῳ; 6.28.1.

Equally relevant are the more frequent attestations to the presence of the *puren* at one terminus of the *mele*. Its form and function have been discussed above. Of course the *puren* occurs on spatulas and the *dipyrene* as well as on the ‘cyathiscomele.’ How, therefore, do we know what type of *mele* the Greek sources have in mind when they refer to the *puren* of the *mele* without more details? Here we need to remember that most, if not all of these surgeries *could be performed* with the spoon probe/‘cyathiscomele’ we have in mind and—a most important consideration—that this article is common in surgical instrumentaria. So, while the terminology used in just about every case allows for application of several probe types, Milne’s ‘cyathiscomele’ has to be included among them.

In several cases the *puren* and *kuathos* of the *mele* are in such close proximity as to insure that it is the ‘cyathiscomele’ in operation. One is Galen’s treatment of ophthalmia with haematite.²⁴⁰ First he advises *pouring* a solution of haematite onto the afflicted part. If that does not work, he then directs us to create a salve of the haematite and apply it with the *puren*. Though the *kuathiskos* is not specifically mentioned, it is clearly implied in the first procedure, which involves pouring. Another relevant passage is Paul’s chapter on venesection. There, in bleeding for chronic ophthalmia, he controls blood flow “by the *kuathiskos* of the *mele*” (διὰ κυαθίσκου μήλης) and for chronic afflictions of head and eyes creates nosebleed “with the *puren* of the *mele*” (διὰ μήλης πυρήνος), all within a few lines (6.40.6).

This brings us to the names *melotis* and *melotris*. Though the *melotris* occurs somewhat less often in the literature than *melotis*, it is generally employed in the same operations. It would seem that the names were in fact interchangeable and used at the whim of surviving medical writers or their sources for the same tool, some like Paul never using *melotris*, Galen, Oribasius and Aëtius both.²⁴¹ The reason for associating *melotis/melotris* with the ‘cyathiscomele’ is basically that it too is sometimes described in the literature as mounting both *kuathiskos* and *puren*.

Witnesses to the presence of the *puren* are Oribasius and Paul in their chapters on anal fistula, the former excerpting from Antyllus and Heliodorus and the latter from Leonides.

²⁴⁰ *Simples* 12.196K.

²⁴¹ See, for example, Oribasius’ lengthy treatment of fistula drawing on Antyllus at *Coll. Med.* 44.19 and the following chapter, *Coll. Med.* 44.20, drawing on Antyllus and Heliodorus. In the former we find *melotis* exclusively, whereas only *melotris* appears in the latter, both passages designating an instrument performing the same functions (see below). This allows for the possibility that Antyllus used both terms indiscriminately.

In cases where the mouth of the fistula is visible, Leonides tracks it by inserting the *puren* of the *melotis* and thrusting it on to the fistula's base. Then, using the *elasma*, surely the shaft of the instrument in this case, as a block or director over which to pass a cutting instrument, he opens the entire canal (6.78.4: ... καθιέσθω ὁ τῆς μηλωτίδος πυρὴν καὶ διωθεισθω εἰς τὸ βάθος, ἐπικόπου τε ὄντος τοῦ ἐλάσματος ὅλη διαιρείσθω ἢ σύριγξ...)

The account of Antyllus and Heliodorus in Oribasius is more detailed but the operation is basically the same. Their procedure also first involves tracking the canal of a fistula, but this time with the *melotris*.

In the case of anal fistula, if the fistula is in plain sight outside of the anal opening but the fistula extends into the anus within, let the olivary enlargement (*puren*) of a *melotris* be inserted and its shaft (*elasma*) thrust through the fistula until it emerges into the anal passage ... If the sphincter cannot be turned out with the anus because of its thickness and the stiffness of the parts, then let the probe be inserted into its depths until it emerges and the bare shaft (*elasma* here = *puren*) of the probe encounters the finger that has been inserted. Then using the probe as a block let the depth of the fistula be cut into further ... (*Coll. Med.* 44.20.53 & 56).²⁴²

Noteworthy is the fact that both accounts show employment of the shaft of the instrument as a director for the scalpel. And, most important for present purposes, is the fact that the *melotis/melotris* used mounts a *puren* at one terminus.

For whatever reason Galen denied this, maintaining in his *Hippocratic Glossary* that the instrument was ἀπυρ<ην>ομήλη, literally “without a *puren*.”²⁴³ No passage in Galen mentioning the *melotis/melotris* contradicts the stance he takes on it in the *Glossary*. In *Anatomical Procedures* he states that the *melotis* was finer than the *dipyrene*, which of course features the *puren* at each terminus, and in the same work he contrasts the *melotis* with instruments having the *puren*.²⁴⁴ Finally, in *Compounds by Place* (12.741K) he calls attention to the point of the instrument (ἄκρον) and to its keenness (τῷ ὀξεί), in the application

242 ἐπὶ δὲ τῆς ἔδρας, φανεράς μὲν οὔσης τῆς σύριγγος ἔξω τοῦ στομίου παρὰ τῷ δακτυλίῳ, ἔνδοθεν δὲ τοῦ δακτυλίου συντετρημένου, ὁ τῆς μηλωτρίδος πυρὴν εἰς τὸ στόμιον ἐντιθέσθω, καὶ διωθεισθω τὸ ἔλασμα, ἕως κενεμβατήσῃ, εἰς τὸν τῆς ἔδρας πόρον... ἐὰν δ' ἐκτρέπεσθαι μὴ δύνηται ὁ σφιγκτήρ σὺν τῷ δακτυλίῳ διὰ πᾶχος καὶ τὴν ἀπὴνειαν τῶν σωμάτων, καθιέσθω ἡ μηλωτρίς εἰς τὸ βάθος ἕως οὗ κενεμβατήσῃ, καὶ τῷ δακτύλῳ καθεθέντι γυμνὸν προσπέσῃ τὸ τῆς μηλωτρίδος ἔλασμα· ἐπικόπου δ' ὄντος τοῦ ἐλάσματος, τὸ τῆς ὑποφορᾶς βάθος ἐπιδιαίρεισθω

243 *Hippocratic Glossary*, 19.85: ἀπυρομήλη· τῇ πυρῇνα μὴ ἔχούσῃ, τουτέστι τῇ μηλωτρίδι.

244 2.581K and 712K. See my discussion (2003) 326–327.

of medicament. A *melotis/melotris* with a plain or pointed terminus (ἄκρον) also appears in the texts of Soranus, Pseudo Galen, and Oribasius.²⁴⁵

If he did not actually overlook the passages in Oribasius and Paul connecting the *melotis/melotris* with the *puren*, Milne apparently did not consider them because he strictly followed Galen and held that *melotis/melotris* applied solely to a separate class of spoon.²⁴⁶ To this class he and others also applied from Galen's Hippocratic Glossary the names *exotis* and *otogluphis*, both translated as 'ear probe' and 'Ohrlöffel'.²⁴⁷ This type features a small, shallow, rotund (usually) or narrow spoon, or a flat round scoop, mounted parallel to, or at an angle to a short plain shaft (ee.gg. Fig. 3, middle row, 9th and 10th from left; Fig. 29.24, 30–35). For present purposes I also include in this category the instrument we now call *ligula*.²⁴⁸ *Ligulae* vary in form but many specimens have the same features as the 'ear probe', being distinguished only by a longer shaft. Though the *ligula* and the 'ear probe' are currently regarded as different, I doubt the ancients made any distinction between them. As the 'cyathiscomele' this device too is frequently come upon in medical instrumentaria, as well as in domestic contexts.²⁴⁹

To continue, the shaft of the 'ear probe'/*ligula* may be rounded or pointed at the terminus opposite the spoon/scoop; but in any case it ordinarily lacks the *puren*.²⁵⁰ While I concede to Milne that the names *melotis* and *melotris*

245 Cf. Pseudo-Galen, *Intro. or Physician* 14.790K = Petit 19.14 (treatment of fistula); Soranus, *Signs of Fracture* 4.1 Ilberg (probing a fracture) and Oribasius, *Coll. Med.* 44.21.13 (threading a fistula with linen thread). However, the Hippocratic work *Diseases of Women*, which likens the rounded terminus of a clyster to the terminus of a *mele*, should caution us against assuming that the term ἄκρον always indicates something sharp: τὸ μὲν ἄκρον τοῦ κλυστήρος λεῖον ἔστω, οἷόν περ μήλης, ἀργύρεον (8.222.14L).

246 Milne (1907) 63–68. Indeed his views were too restrictive even within this class; see Bliquez (1982) 207–9 and Künzl (1983a) 28.

247 19.122K: ἑξωτὶς (sc. μήλη); ὠτογλυφίς. These terms may have been more popular in the lay community. Among medical authors only Galen mentions them, *exotis* just once in the *Hippocratic Glossary*, the *otogluphis* twice in *Cmpds. by Place* 12.659K & 12.688K [Apollonius of Citium].

248 For the Romans the *ligula* was a type of tablespoon; see Henry Thédénat's essay s.v. in Daremberg, Saglio, *Dict. des antiquités grecques et romaines, etc.*, s.v. 111/2 1253–1254. For examples of the 'ligula' see Bliquez, Jackson (1994) 154–156(185–193); Milne (1907) 77–79 and Pl. xviii. The earliest examples known to me are Augustan. See Künzl (1991b) 193–195.

249 Künzl (1983a) 48(16.30–35), 50(18.9 & 11), 99(79).

250 There are occasional exceptions as, for example, a specimen in Rome treated recently by Ralph Jackson: see Gazzaniga (2000) 199–200. There is no reason to suppose that it was ever employed by a physician. A second specimen in Pompeii likely was: see Bliquez, Jackson (1994) 49 & 202(A3).

covered the ‘ear probe’/*ligula* as well, clearly Galen’s views were too restrictive. Leonides, Antyllus, and Heliodorus, were all surgeons of renown in antiquity and contemporaries or approximate contemporaries of Galen. For them the *melotis/melotris* was not necessarily ἀπυρηνομήλη, as we have seen.²⁵¹

As to the spoon of the *melotis/melotris*, we may have recourse to both Oribasius and Paul who, for example, refer to a special model called *traumatike* or ‘for wounds.’ Oribasius, who focuses on treatment of skull fracture, pries up bone partially excised by drilling and chiseling “with levers or a lever and by means of the *kuathiskos* of the *traumatike melotris*” before plucking it out with the bone forceps.²⁵² Paul uses quite similar language in removing sling driven missiles though, as usual, he employs the term *melotis* as opposed to *melotris*.²⁵³ Levering up bone and sling bullets should require a sturdier spoon/scoop than the type mounted on the delicate little ‘ear probe.’ The use of other heavy-duty tools in this operation such as bone levers and bone forceps make that clear, if it were not already obvious.²⁵⁴ As opposed to the ‘ear probe’, such surviving specimens of the ‘cyathiscomele’ as feature a large sturdy *kuathiskos* and a thick shaft will have served well for this type of heavy-duty surgery. Compare the example in Fig. 20.4–6 (from rt.) with the ear probe/*ligula* types shown in Fig. 29.30–35. Note that many a ‘cyathiscomele’ also has a shaft that is striated as well as sturdy.²⁵⁵ This type of shaft makes the ‘cyathiscomele’ well suited to function as a block or director, the girth of the shaft serving to support the blade of a cutting tool and the striation for keeping it on track, as required by Leonides, Antyllus, and Heliodorus.

One last remark about the *traumatike melotis/melotris*. It is surely Oribasius’ *traumatike melotris* and Paul’s *traumatike melotis* that Galen has in mind when, in his *Hippocratic Glossary*, he defines the Hippocratic term ‘stout probe’ as ‘the *traumatike mele*’ (μήλην ἰσχυρήν· τὴν τραυματικὴν μήλην: 19.122K). It is important to note here how the terms *mele*, *melotis* and *melotris* interchange with ease,

251 Perhaps in the immediate circles in which Galen moved, the names *melotis* and *melotris* were limited to the ‘ear probe’; or, owing to his well-known interest in precise language perhaps Galen himself attempted to restrict the application of these terms.

252 *Coll. Med.* 46.11.26: μετεωριζέσθω δὴ πρῶτον τοῖς ἀναβολεύσιν ἢ μετ’ ἀναβολέως καὶ τῷ κυαθίσκῳ τῆς τραυματικῆς μηλωτρίδος· ὅταν δ’ ἄνω μετεωρισθῇ, τότε ὁστάγρᾳ ἀναιρείσθω...

253 δεῖ δὲ ταῦτα μοχλεύσαντα δι’ ἀναβολέων ἢ κυαθίσκου τραυματικῆς μηλωτίδος ἀναβάλλειν, εἰ δὲ προσδέχοιτο, καὶ δι’ ὁδοντάγρας ἢ ριζάγρας ἐξέλκειν (6.88.9).

254 For these tools, see ss.vv. below, sections on Bone and Tooth Instruments and Forceps. See also Künzl (1983a) 106(85.2) for forceps; 77(51.29), 82(56.10–13), 101(56.4–5), 106(85.11) for levers and Bliquez, Jackson (1994) 58, 171(242) for forceps; 43, 131(91–93) and 206(A19) for levers.

255 See examples in Bliquez (2003) 322 Fig. 1.

not only supporting my contention that the terms *mele/melotis/melotris* could designate the same instrument but also showing again just how fluid the terminology applied to surgical tools could be at the time of the Roman Empire.

At this point we may consider more closely selected applications of the *mele* or *melotris/melotis* which could have been performed by the ‘cyathisomele’ as well as, or even better than other probe types which were also designated by these names. These include prying out growths, foreign objects from the ear and in applying medicine to the eye, ear, nose, and gums, often with a woolen swab. In this respect the *puren* of the instrument will have accommodated a woolen swab as well as a plain point (ἄκρον) and both *puren* and *kuathiskos* (in the case of smaller specimens) will have been capable of being inserted into the auditory canal for removal of earwax and foreign objects.²⁵⁶ Indeed, because the bowl of its *kuathiskos* is usually deeper, it may have been even more efficient than the ‘ear probe’ in performing this function.

As noted previously, Paul (6.28.1) brings the *kuathiskos* to bear in filing down broken or uneven teeth, so that some specimens must have had bowls that were burred, like a file. This is precisely the case with two specimens thought to be from Ephesus and now in Mainz (Fig. 20, 5th and 6th from rt.). In these cases the roughened surface is on the interior of the bowl rather than the convex side. This may make them less practical for what Paul has in mind. But the point is that roughening or burring of the surface of these tools is manifest on surviving examples. If ancient smiths could roughen the interior of a bowl, they could just as easily have roughened the exterior.

It may be a spoon of this type that Cassius Felix recommends for scraping away callus resulting from fistula: *ex melotida ferrea leviter radendo purgabis*... (20.6). Incidentally, if we take this passage literally, there were iron models.

The roughened interiors on the Mainz spoons may have served another purpose described in the sources. Philagrius, in a passage excerpted by Aëtius, describes a case in which he was able to pry out a stone lodged close to the terminus of the male urethra on the glans side with a narrow *melotris*.²⁵⁷ This levering maneuver was likely performed with the *kuathiskos*, as that is the part of the instrument most apt to be called narrow. As I envisage the proce-

256 I have proved this by experimenting with instruments in the collection of my department. Taking up a small ‘cyathiscomele’, I inserted the *kyathiskos* into my ear as far as any of our ‘ear probes’ and a modern cue tip could be thrust. For the piece in question see Bliquez (1998) 85(13).

257 Aëtius 11.5.92–93:... τῇ οὖν στενῇ λαβίδι ἠδυνήθημεν τοῦτον ἐξελκύσαι, μοχλεῦντες ἡρέμα στενῇ μηλωτρίδι.

dure, Philagrius engaged the stone by placing the bowl edge of the *kuathiskos* against the exterior undersurface of the penis and then gradually rocked the stone forward until it appeared at the mouth of the urethra where it could be gripped with a forceps. (See below for Celsus' account of the same operation, which offers support to this view.) Be that as it may, the *melotris* is associated by Philagrius with stone removal, and that might explain the roughened interior bowls of the Mainz specimens. Note that the Mainz spoons are part of an instrumentarium containing the *lithotomon* (Fig. 20, 1st and 2nd from rt.; Fig. 29.18). The scoop-like retractor of the *lithotomon*, called *lithoulkos* (λιθουλκός), features the same kind of roughened interior as the spoons, the better to engage and grip the stone after it has been exposed at the neck of the bladder, in this case by incision with the blade of the instrument. This suggests that the interior of the bowls of the Mainz spoons may have this feature for the same reason. They too may have been useful under certain conditions for purposes of extracting stone exposed at the neck of the bladder.²⁵⁸

It may also have been its *puren* that Aëtius (16.108.8) has in mind when he recommends opening imperforate womb with a small *melotris* (μῆλωτριδίω). One observes in examining surviving specimens of the 'cyathiscomele' that its *puren* is many times oblong and pointed. This shape of *puren* is especially well suited for insertion into fistulous canals, or for being thrust through tissue like the hymen. Finally, the various shapes of the *puren* will have been very well suited for delicate cauterization operations, such as those performed around the eyes (as in Paul 6.13.1; 6.22.1).

Perhaps another function of the 'cyathiscomele' is passed on in the *Hippocratic Glossary* composed by Erotian in the first century. There he equates the name *katoptron* with the *melotis* of his contemporaries: κάτοπτρον ἢ μῆλωτίς (90.15). Nowhere in the surviving *Hippocratic Corpus* do we find *katoptron* used to designate a surgical tool.²⁵⁹ Odds are, therefore, that Erotian has in mind the *katopter* (κατοπτήρ), a device to dilate the rectum found in the Hippocratic treatises *Hemorrhoids* (5P) and *Fistulas* (3P). If Erotian has in mind a tool for dilation, then by *melotis* he apparently envisages a spoon or scoop inserted into the rectum and used to expand it by upward, downward or sideways pressure, just as a modern tongue depressor or retractor might be

²⁵⁸ So too Künzl (1999) 208. For details of this operation and another view of the purpose of these burred specimens, see Künzl (1983b) 487–493. The same instrumentarium also features the *lithoulkos* mounted opposite a double pronged hook: Fig. 20, 3rd from rt.

²⁵⁹ It appears once in the ordinary sense of 'mirror' in one of the Hippocratic Letters; see Littré's edition of Hippocrates, vol. 9, 27.266.

employed in the mouth and female parts respectively.²⁶⁰ This being the case, surely a type of ‘cyathiscoele’ with a large spoon and thick shaft would be more practical for rectal dilation than the smaller and less sturdy ear scoop. This suggests that Erotian is thinking of the former when he equates *katoptron* and *melotis*.²⁶¹

If Greek nomenclature is imprecise when it comes to instruments of surgery, Latin sources are even more vague, the common designation for all types of probes in Celsus being simply the term *specillum*.²⁶² With this he performs a number of surgeries executed by the *mele* or the *melotis/melotris* in the Greek sources of interest to us. For example, apart from the usual probing or preparation and application of medication, often with a woolen swab, we find Celsus tracking anal and other types of fistula with the *specillum* and using it as a director or block in cutting into fistulous canals (5.28.12C & L; 7.4D).²⁶³ Of great interest is the fact that on many occasions Celsus modifies *specillum* with the adjective *oricularium*.²⁶⁴ Given the literal meaning of *oricularium* (‘relating to the ear’) it is easy to agree with Milne when he links the *oricularium specillum* to the *auriscalpium* (literally ‘ear scraper’), an instrument deployed by

260 I have in mind spoon-like models such as ‘Beck’s and Reverdin’s Abdominal Spatulas’ as advertised in the *Catalogue of Surgical Instruments of Superior Quality* offered for sale by Biddle and Crouther Inc. of Seattle, WA., (24th edition, 1935), pp. 99–100 (2019–2020).

261 Erotian (*Hippocratic Glossary* 97.2–3) also mentions the *melotis* in his attempt to identify what Hippocrates regarded as a *mele*: μήλην οὕτω καλεῖ (sc. Hippocrates) τὴν μῆλωτιδα. ἣν γὰρ ἡμεῖς μήλην καλοῦμεν, αὐτὸς ὑπάλειπτρον καλεῖ. (“This is what he calls the *melotis*; what we call *mele* he calls *hupaleiptron*”). It seems in this instance that Erotian considered the names *melotis* and *mele* as designating distinct instruments. The question is, what did Erotian envisage as an *hupaleiptron*? If, as suggested above, he could call a ‘cyathiscoele’ a *melotis*, then for him the *hupaleiptron* was likely a spatula probe.

262 Caelius Aurelianus, in his translation of Soranus, prefers Greek terms: *Chron. Diseases* 2.3.68 (application of warm olive oil on a swab for earache *per melotida*); *Chron. Diseases* 5.2.33 (removal of stones bursting through skin in severe cases of gout *cyathisco fermento*).

263 For probing and medicating see the references under Simple Probe.

264 Except in the case of *specillum oricularium* modifiers for *specillum* are rare, as is any description of its parts. The *puren*, for example is never mentioned (unless this is what Celsus means by *principium* at 5.28.12L) until Theodorus Priscianus in the fourth century designates it as *baca* or *bacula* (berry/little berry) or *pyrena meles*; see Euporiston 1.37, 44, *Ant. Bru.* 4 and Add. 18 (21). Scribonius Largus once applies medicament to piles *specilli latitudine*, which one is tempted to take as referring to a spatula probe because it seems in contrast to the *auriscalpium* used for the same purpose immediately below: *Compositiones* 227.

Celsus' contemporary, Scribonius Largus;²⁶⁵ for, in terms of their root meaning both names seem applicable to the same instrument.²⁶⁶ But Milne goes too far when he maintains that the *specillum oricarium* and the *auriscalpium* invariably refer to the 'ear probe', which he connects exclusively with the *melotis/melotris*. The stumbling block is provided by Scribonius himself. In treating piles Scribonius applies medicament *auriscalpio averso*, stating that the name *auriscalpium* is what the Greeks mean by *kuathiskos*.²⁶⁷ Scribonius seems here to rub medicine on the afflicted area with the *kuathiskos* of the *auriscalpium* turned over or *adverso*; that is, with its back side.²⁶⁸ Celsus uses similar language when he performs several operations *specillo averso*. It seems then that the expressions *specillo averso* and *auriscalpio averso* mean the same thing: 'with the back of the *kuathiskos*.' The term *kuathiskos* immediately puts us in mind of the 'cyathiscomele' and allows for the possibility that at least some of the time the *kuathiskos* of the 'cyathiscomele', as opposed to the *kuathiskos* of the 'ear probe', lurks behind references to the *specillum oricarium* and the *auriscalpium*. This suggestion can be supported by the fact that again, in a number of striking instances, Celsus, as Scribonius, uses the *specillum oricarium*, *specillum aversum* and the *auriscalpium* to perform operations executed with the *mele* and the *melotis/melotris* in Greek sources:²⁶⁹ e.g., to foment with oil for toothache (6.9.3), to pry foreign objects from the ear (6.7.5, 6.7.7 and 6.7.9), for eye work, as in separating adhering eyelids (7.7.6B *spec. avers.*), and to maneuver tissue and vessels in treating hernia (7.21.1; 7.22.4 *avers. spec.*). Particularly striking is the fact that, like Philagrius, Celsus removes bladder stone impacted in the urethra (7.26.1C). This he achieves *oricario specillo* or, alternatively, "with the instrument for extracting a stone after incision."²⁷⁰ Surely Celsus means by the latter the Greek *lithotomon* with its scoop-like retractor or *lithoulkos*. This procedure apparently does not require an incision because Celsus next details a second operation in which he emphasizes actually cutting into the urethra to remove the stone.²⁷¹ Therefore, as the *lithoulkos*

265 Milne (1907) 63–68. In the main, Scribonius uses the *auriscalpium* for the application of medicament: *Compositiones* 41; 56; 227; 230.

266 *Auriscalpium* may have been the more popular designation because it appears in Martial's *Epigrams* (14.23).

267 *Compositiones* 227: *auriscalpio averso, quam partem κυαθίσκον Graeci vocant.*

268 Here I agree with Milne who understands *adverso* in this way.

269 A later glossary is quite specific with respect to *auriscalpium* (see *Herm. Mon.* 207.59: *milotis ari scalpium*).

270 ... eo ferramento quo in sectione calculus protrahitur.

271 *Si id fieri non potuit, cutis extrema quam plurimum adtrahenda et condita glande lino uinc<i>enda est; deinde a latere recta plaga col<e>s incidendus ...*

is much too large to be inserted into the urethra, Celsus must in the first procedure have used it or the spoon of the *oriculario specillo* to rock or prod the stone toward the mouth of the urethra. If so, his method of operating coincides with the method apparently followed by Philagrius, who employed a *melotris*; that is, a 'cyathiscomele' for this purpose.

For a *specillum asperatum* to curette eyelids indurated by trachoma see below, Curette for Eyelids.

Here now is a full catalogue, organized under all terms used for spoon probes save for *mele*. Passages in which *mele* is, or could be understood to mean spoon probe have been treated above.

Melotis

Application of Medicaments, etc., often with Woolen Swab: for earache ([Dioscorides], *Euporista or Simples* 1.56.1; Galen, *Cmpds. by Place* 12.60.3, 617 [Apollonius] & 12.660K [Crito], Galen, *Comm. Hipp. Epid.* 6, 17b.266K [Wenkebach p. 282] = Alexander of Tralles, *Therap.* 2.81.26, 83.4; Oribasius, *Eunap.* 4.36.9; Paul 3.23.1.35 and 53; Caelius Aurelianus, *Chron. Diseases.* 2.3.68); for hypersarkosis in ear ([Dioscorides], *Euporista or Simples* 1.59.1; Oribasius, *Eunap.* 4.43); with adhesive for ciliary hairs (Galen, *Cmpds. by Place* 12.741K [Heracleides of Tarentum]; Dioscorides, *Mat. Med.* 1.73.3 & 5.145.1; Oribasius, *Syn.* 3.153); for fomenting painful gums (Galen, *Cmpds. by Place* 12.875K); fomentation for loose teeth (Galen, *Cmpds. by Place* 12.882K); for mouth and gum disease ([Dioscorides], *Euporista or Simples* 1.75.2; Galen, *Cmpds. by Place* 12.958K); for trichiasis (Oribasius, *Eunap.* 4.20.4); for *ozaina* and nasal polyp (Oribasius, *Eunap.* 4.45.7); for gum disease (Dioscorides, *Mat. Med.* 1.105.5; Oribasius, *Eunap.* 4.66.4); deafness and pain (Alexander of Tralles, *Therap.* 2.77.5).

Probing, Piercing: anal fistula (Pseudo-Galen, *Intro. or Physician* 14.789K = Petit 19.14); narrow fistula (Oribasius, *Coll. Med.* 44.19.2); bone corrupted by fistula (Oribasius, *Coll. Med.* 44.19.3); crooked fistula with tin or lead model easily bent (Oribasius, *Coll. Med.* 44.19.5); fractures (Soranus, *Signs of Fracture* 2.2 [simple fracture], 4.1 [arched fracture], 11.1 [nose] Ilberg).

Inserting: linen thread into anal fistula for apolinosi (Pseudo-Galen, *Intro. or Physician* 14.790K = Petit 19.14).

Cleaning or Clearing: ears ([Dioscorides], *Euporista or Simples* 1.65.1; Cassius Iatrosophistes, *Quaest. Med.*, 1.21.2; Oribasius, *Ecl. Med.* 10.4, *Eunap.* 4.39.8; Alexander of Tralles, *Therap.* 2.95.25 & 97.10; Paul 3.23.9 & 6.24.1).

Scraping: callus of fistula (Cassius Felix 20.6).

Levering/Retracting/Extracting: tophi symptomatic of gout (Caelius Aurelianus, *Chron. Diseases* 5.2.33);²⁷² guiding ciliary hairs into extraction loop (Paul 6.13.1); positioning adhesion of eyelid for scalpel (Paul, 6.15.1) and extracting chalazion (Paul 6.16.1).

Cauterizing: ciliary hair (Paul 6.13.1).

Director/Block: for fistula (Paul 6.78.2 & 4); for exploring torcular Herophili (Galen, *Anat. Proc.* 2.712K = 11.557Gar).

Melotris

Application of Medicaments, etc., often with Woolen Swab: for nosebleed (Galen, *Cmpds. by Place*, 12.691–692K [Heracleides of Tarentum]); for suppuration/ulceration in ear (Aëtius 5.125.2 & 6.81.15); for nasal polyp (Aëtius 6.92.72); for diseased gums (Aëtius 8.25.3); for irritating ciliary hairs (Aëtius 7.70.2–8 = Hirschberg, Waugh pp. 104–105. Chp. 70); water to cool trephine (Oribasius, *Coll. Med.* 46.11.11).

Probing, Piercing: skull fracture (Oribasius, *Coll. Med.* 46.7.2 [Heliodorus]); carious skull (Oribasius, *Coll. Med.* 46.22.4 [Heliodorus]); scrotal fistula (Oribasius, *Coll. Med.* 44.20.76 [Antyllus and Heliodorus]); imperforate womb (Aëtius 16.108.8).

Inserting, Supporting: linen thread into anal fistula for apolinosi (Oribasius, *Coll. Med.* 44.21.12–14 [Meges]); to keep feather shaft from collapsing in preparation of an *ipoterion* (Oribasius, *Coll. Med.* 50.9.10 [Heliodorus], see s.v. under Appendix: Materials, Sutures, Plugs, ‘Tents’, etc.).

Cleaning or Clearing: of object from ear (Galen, *Cmpds. by Place*, 12.656–659K [Archigenes and Apollonius]; Aëtius 6.78.2 & 6.87.2); shavings of trephined skull with wool swab (Oribasius, *Coll. Med.* 46.11.10 and 30); blood from meninx after trephining (Oribasius, *Coll. Med.* 46.19.1); melikraton used in treating abscess in rib area (Oribasius, *Coll. Med.* 44.7.16).

²⁷² Actually Caelius says that the tophi may be pried away with a *cyathiscus* that is called *laureolus/um* (...*exilientes cyathisco ferramento tollantur quod nos laureolum dicere poterimus*—*Chron. Diseases* 5.2.33). But by *cyathiscus* he surely means ‘cyathiscomele’, which he once cites elsewhere as *melotis* (*Chron. Diseases*. 2.3.68).

Levering/Retracting/Extracting: ocular lithiasis (Aëtius 7.82.5 = Hirschberg, Waugh pp. 118–119. Chp. 82); chalazia (Aëtius 7.83.11 = Hirschberg, Waugh pp. 120–121. Chp. 83); ganglia, melikerides, steatoma, atheromata (Aëtius 7.85.8–9 = Hirschberg, Waugh pp. 122–123. Chp. 85); bladder stone near the tip of urethra (Aëtius 11.5.92–93 [Philagrius]); skull fragments (Oribasius, *Coll. Med.* 46.11.26).

Director/Block: for anal fistula (Oribasius, *Coll. Med.* 44.20.53–59, 63 & 66 [Antyllus/Heliiodorus]).

Specillum, Oricularium Specillum, Auriscalpium

Application/Manipulation of Medicaments, etc., often with Woolen Swab: for swelling and ulceration in ear (Scribonius Largus, *Comp.* 41); for toothache (Scribonius Largus, *Comp.* 56); hemorrhoids *auriscalpio averso* (Scribonius Largus, *Comp.* 227); for uvula (*Comp.* 230). Cf. also Martial, *Epigrams* 14.23.

Cleaning or Clearing: worms from ear with *oric. specill.* (Celsus 6.7.5); incrustation in ear and ear wax *oric. specill.* (Celsus 6.7.7B); foreign object in ear with *oric. specill.* (Celsus 6.7.9); stone at mouth of urethra *oric. specill.* (Celsus 7.26.1C), medicated linen for piles *oric. specill.* (Celsus 7.30.3D).

Levering/Retracting: separating adhering eyelids with *specillum aversum* (Celsus 7.7.6B); pushing omentum back into abdominal cavity in treating scrotal hernia *av. spec.* (Celsus 7.21.1); pushing veins back into inguinal wound in correction of varicocele *av. specill.* (Celsus 7.22.4); reopen bladder incision *av. specill.* if stone not completely removed (Celsus 7.27.8).

Melotris Terminating in a Spiral

In describing treatment of anal fistula by the ‘apolinosis’ method, for insertion of the linen cord the surgeon Meges requires a *melotris* with an eye at one terminus. “Or,” he says, “having, as it were, a spiral at the end, let it be spun around in the shape of a snail shell.”²⁷³ I know of no probe of this type to have been recovered.

Milne, who cited no literary source, posited that the ancients employed a ‘screw probe.’ His belief was grounded on an instrument found in the Roman Camp at Sandy, which resembled the screw probe known in his time.²⁷⁴

²⁷³ Oribasius, *Coll. Med.* 44.21.12: . . . ἢ οἷον ἔλικοι πρὸς τὸ πέρατι καὶ εἰς σχῆμα κοχλίου δινωθήτω . . .

²⁷⁴ (1907) 68 & Pl. XXI.5.

Unfortunately, there is no way to affirm the function of the Sandy instrument or its association with Roman medicine.

Anchor Probe: ankuromele (ἄγκυρομήλη)

Erotian (51.5) and Galen (19.69K) alone preserve this term in their *Hippocratic Glossaries*, equating it with the common retractor called ἄγκιστρον/*angkistron* (see Retractors and Hooks, s.v. Sharp Hook) abundantly attested in Imperial texts. *Ankuromele*, is not a name found in the *Hippocratic Corpus* that has come down to us; so we do not know what prompted Erotian and Galen to equate the term with the contemporary *ankistron*. *Ankur*—‘anchor’—in the compound indicates that some sort of retractor was surely at issue. Yet, the fact that—*mele* is included should mean that the instrument could also be used for probing. A sharp hook in the Naples Museum and one from Cyzicus feature a needle at their opposite ends (Fig. 42 = Fig. 84, 4th from rt.; Fig. 83, lower row, far left).²⁷⁵ As the needle could be used for probing and fine dissecting, it may have been this type of *ankistron* that Erotian and Galen took as representing the Hippocratic *ankuromele*, whatever it was.

Curette for Eyelids (ophthalmike mele?)

Among the instruments brought to bear on the papillary growths and indurated eyelids consequent on trachoma was a type of curette. Celsus calls the instrument an *asperatum specillum*, while Paul (3.22.12) terms it *blepharoxustion* (βλεφαρόξυστον). To quote Celsus:

In this type of situation some scrape off the thick hard eyelids with a fig leaf and a roughened probe (*asperato specillo*) and sometimes with a scalpel, and they evert and rub them daily with medicaments (6.6.27).²⁷⁶

The name *asperatum specillum* offers a clue as to the instrument’s appearance: if it could be called a *specillum*, i.e., a probe, it must have been a shaft with a roughened terminus.

The testimony of Celsus and Paul establish that the instrument was in use from at least the first to the 7th centuries; but, as only these two authors mention it, its use does not seem to have been widespread. The reason is surely that,

²⁷⁵ Bliquez, Jackson (1994) 128(81) and 166(230). Cf. also 128(80), which mounts a small *ligula*.

²⁷⁶ *In hoc genere valetudinis quidam crassas durasque palpebras et ficulneo folio et asperato specillo et interdum scalpello eradunt, versasque cotidie medicamentis suffricant.*

as Celsus and Paul make clear, a simple scalpel or various natural substances like pumice stone, fig leaves, or the shell of a cuttle fish could be used instead.²⁷⁷

Milne favored a piece, supposedly from Herculaneum, used as an illustration in Védrenes' 1876 edition of Celsus as the instrument in question.²⁷⁸ The drawing shows a shaft mounting a *puren* at one end, a tiny four-sided file at the other and a broad raised band midway to serve as a handle. The piece itself actually survives and is presently housed in the Musée d'Histoire de la Médecine, Université René Descartes, Paris. While it is in poor condition, it does not appear ever to have had a *puren*, there is no handle midway, nor does one detect ridging to indicate a file on its squarish terminus. This and the fact that precise provenance of the piece is unknown causes one to doubt that this item ever served as a surgical instrument.

Milne also entertained a second possibility. This was a type of spoon burred on its convex side recommended by Lorenz Heister in his *Institutiones chirurgicae*.²⁷⁹ Now, as it happens, there was in antiquity a type of spoon probe associated with the eyes. Its existence is attested in Galen's *Hippocratic Glossary* (19.122K). In attempting to elucidate a probe (*mele*) with an expanded surface (*platos*) cited in the Hippocratic *Regimen in Acute Diseases*, Appendix 70P = 2.37.1Littre, Galen identifies the expanded surface as "the *kuathiskos* of the ophthalmic" probe treated above. Milne classified this ophthalmic probe as a separate type, but it is conceivable that the burred probe employed by Celsus and Paul and the spoon mentioned by Galen and later by Heister are one and the same.

The spoons/scoops that we find in surviving instrumentaria are all of standard types: ear scoops, *ligulae* and Milne's 'cyathiscomele', the instrument identified above with the *melotis/melotris*. It may be that a particular model of this instrument, appropriate in size and shape and with a roughened *puren* or bowl (compare those in the Mainz Museum shown in Fig. 20, 5th and 6th from rt.) was called an *ophthalmike mele* when employed in eye surgery. One here recalls Paul's employment of the *kuathiskos* of a *mele* to file down teeth (6.28).

277 We depend on Paul for all of these natural substances: εἰ δὲ σκληρὸς ὢν ὁ τύλος μὴ τοῦτοῖς (collyria) εἴκοι, ἐκστρέψαντες τὸ βλέφαρον ξέσωμεν διὰ κισήρεως ἢ σιγπέας οστράκου ἢ φύλλων συκῆς ἢ καὶ διὰ τοῦ ὄργανοῦ τοῦ βλεφαροξύστου καλουμένου.

278 Milne (1907) 71–72. The drawing is closely associated with one 'Tenon', probably the physician and author Jean Claude Tenon. For the drawing and a photo of the piece in its present state, see Bliquez, Jackson (1994) 14–15 and Pls. I (7) and III (8). Drawings of surgical instruments made in the late 18th and early 19th century are extremely stylized and often omit details or include false ones. Spencer too (Loeb Celsus) *ad loc.* opted for a rasp.

279 Leiden, 1739 (a Latin version of his *Chirurgie* of 1718, I, 591, Tab. XVI). I have not seen Heister's text and rely on Milne's summary of it.

Mele diastellousa (μήλη διαστέλλουσα)

A term used once by Galen to define the Hippocratic μήλη διαστομωτρίς, a type of uterine dilator (*Hippocratic Glossary* 19.92K). See below, Gynecological and Obstetrical Instruments, s.v. Large (Uterine) Speculum, and above: Hippocratic Surgeries and Surgical Tools, s.v. Probes)

Mele Ischure (μήλη ισχυρή) or Mele Traumatike

Mele ischure is yet another entry in Galen's *Hippocratic Glossary* (19.122K). As is characteristic of the *Glossary* the name is briefly defined without further comment as “wound probe” (μήλη τραυματική). *Mele ischure* does not occur in any preserved Hippocratic treatise but, as Galen connects it with wounds, he likely found it in the lost tract *On Wounds and Missiles*.²⁸⁰

In this case, however, we can marshal information from other sources to enlarge the picture. In their extensive treatments of wounds caused by missiles Oribasius and Paul tell us in almost identical language that missile points can be removed “with bone levers or with the scoop of a wound probe.”²⁸¹ We have noted above that a standard feature of the *melotis/melotris* is its spoon or scoop. Probably all that was meant by *mele ischure* in Hippocrates was, if not a lever, a sturdy scoop or spoon of appropriate size and shape and for Galen, Oribasius and Paul a suitable ‘cyathiscomele’ (see above Spoon Probes).

Scoop of Diocles

In discussing extraction of a broad imbedded missile Celsus describes a special scoop for the purpose. He calls it by its transliterated Greek name *cyathiscus Diocleus* (7.5.3-B), identifying the inventor as Diocles of Carystus.²⁸² The text is variously translated and the instrument, consequently, variously reconstructed.²⁸³ My version follows those of Milne, Meyer-Steineg and van der Eijk (fr. 167, pg. 269).

A plate of iron or bronze has also two downward curved hooks at one end; on the other it is folded up on the sides and its terminus leans slightly to the part (sides) where it is folded. Moreover, it is also drilled through

²⁸⁰ For reconstructions of *On Wounds and Missiles* see Salazar (1998) and Witt (2009) 234–270.

²⁸¹ Oribasius, *Coll. Med.* 46.11.26 (μετ’ ἀναβολέως καὶ τῷ κυαθίσκῳ τῆς τραυματικῆς μηλωτρίδος); Paul 6.88. 9 (δὲ ἀναβολέων ἢ κυαθίσκου τραυματικῆς μηλωτρίδος).

²⁸² For Diocles, see Daniela Manetti’s entry in Keyser and Irby-Massie (2008) 255–257.

²⁸³ Spencer has quite a different impression but forces the Latin. He envisages an instrument in two parts, comparing it to the modern obstetric forceps. A spoon (*cyathiscus*) does not come in two parts.

there. The instrument is inserted at an angle close to the missile. Then, when it comes to the missile's point, the instrument is twisted little by little so that it receives the missile in the drilled opening. When the missile is in the opening, then fingers positioned under the hooks on either side draw out the instrument and the missile simultaneously.²⁸⁴

However difficult it is to understand the language of Celsus, the Scoop of Diocles seems to have consisted of a plate of iron or bronze with a set of downturned grips at one end and, at the other, a shallow oblong spoon with inwardly flanged edges and a perforated base. The idea was to maneuver the missile into the flanged edges, engage its point in the perforation and then make traction with the grips to withdraw it.

As in the case of the lithotomy knife of Meges, it seems that this virtuoso scoop did not become widely popular. Like other virtuoso instruments, it is mentioned only by one author, and there is only one possible survival (see below). In most cases a retractor and a sturdy forceps must have been preferred in weapons removal. While it is a clever apparatus, Diocles' scoop may have been not much more practical to use than a spoon of appropriate size and shape, when a spoon-like instrument was desirable. And, in fact, a spoon shaped instrument called *traumatike melotis* is mentioned by Oribasius and Paul (see immediately above).

As noted above, there has been considerable difference of opinion on the specific shape of Diocles' scoop. All that seemed resolved when Meyer-Steineg published a shoehorn shaped item from his collection, allegedly from Ephesus (Fig. 44). As it features the grips, the flanges, and the perforation at its base, it fits the description in Celsus quite well. Unfortunately, the antiquity of this (and a similar companion) piece is now in considerable doubt.²⁸⁵ A more promising candidate is an iron instrument recovered recently in the Domus 'del chirurgo' at Rimini (Fig. 43a–b).²⁸⁶ As preserved, it consists of an iron shaft with a small, perforated spoon at one terminus. Unfortunately, the other, which, theoretically, would have mounted the hooks for retraction, is broken

284 *Lamina uel ferrea uel aenea etiam ab altero capite duo utrimque deorsum conuersos uncus habet; ab altero duplicata lateribus, leuiterque extrema in eam partem inclinata, qua sinuata est, insuper ibi etiam perforata est. Haec iuxta telum transuersa demittitur; deinde ubi ad <imum> mucronem uentum est, paulum torquetur, ut telum foramine suo excipiat. Cum in cauo mucro est, ilico digiti subiecti partis alterius uncus simul et ferramentum id extrahunt et telum.*

285 Künzl (1991a) 26–27 and (1991aa) 522–525.

286 See S. De Carolis (2007) and (2009).

off. A second issue is the nature of the spoon. While it has slightly raised edges (described as “leggermente sollevata ai bordi”) and is raised at its distal end, it is not apparent that it is much flanged; and, given its small size (ca. 1 inch long), any point it might engage would have to be a small one. In favor of its proposed identity as Diocles’ scoop is the fact that it was recovered in a very rich surgical (also considered military) context, and it is not clear what else it could be.

Impellent

Among the numerous instruments employed by Paul in his lengthy chapter on extraction of missile points is a device called the διωστήρ/*dioster* or ‘impellent.’ The purpose of the *dioster* was to push through and out a point lodged in the flesh, as opposed to withdrawing it with a forceps. Paul may be the source for the presence of the *dioster* on *Lists*, as it is found nowhere else in the sense of ‘impellent.’²⁸⁷

Of its appearance Paul says only that it had a male end and a female end. The surgeon engaged the socket of the point with the former; if it was fashioned with a tail (i.e. a tang) then he applied the latter (6.88.4).²⁸⁸ That the *dioster* must have been a shaft-like instrument is shown by the application of the same name by veterinarians to a probe smeared with honey for treating inflamed tonsils in horses (*Hippiatrica Ber.* 16.2.8 and 18.1.8), and also by the use of the name to render in Greek the poles used to carry the Ark of the Covenant (*Lxx., Ex.* 38.4.1, et passim). These passages, combined with Paul, lead to the conclusion that the *dioster* was a sturdy probe-like instrument with one end pointed or rounded and one sunken.

No surviving instrument has so far been shown to fit this description. If the *dioster* was biodegradable, e.g., merely a shaft of wood, that would explain why.

Stylus

The metal stylus, with a pointed terminus for inscribing letters and a plate at the other for erasing them, is of course associated with writing, not medicine. But, like the spatula and the *dipyrene*, it found a place in medicine, though much less frequently. Galen uses the sharp end of a stylus in dissecting as a probe to pierce a blood vessel,²⁸⁹ and to extract for medication the mucus-like

²⁸⁷ Schoene (1903) 282; Bliquez (1984) 199.

²⁸⁸ εἰ μὲν οὐραχὸν ἔχοι τὸ βέλος . . . τὴν θήλειαν τοῦ διωστήρος καθέντες καὶ ἐναρμόσαντες ὡθήσομεν τὸ βέλος, εἰ δὲ αὐλὸν, τὸν ἄρρενα.

²⁸⁹ *Blood in the Arteries* 4.716K.

fluid of land snails.²⁹⁰ More apropos to surgery, Aëtius applies heated medication to an aching tooth (8.35.47), while Galen (*Cmpds. by Place* 12.864K), followed closely by Aëtius (8.36.6), levers out teeth with the plate of the stylus.

These few references are supported by the occasional find of a stylus in a surgical kit. We may cite examples from Asia Minor (Fig. 3, bottom row, below cautery; Fig. 29. 27), Viminacium, Varna, Aquincum and Locarno.²⁹¹

The Greek term in medical contexts is regularly *grapheion*/γραφεῖον.²⁹² One can only guess at what lies behind the ὑπογραφίς in Pollux' list of surgical instruments and paraphernalia (Be10.149; cf 4.181). As he once references the term as a marking device (7.128), his ὑπογραφίς might be a device for marking out areas to be incised or burned.²⁹³ The same may be true of the γραμμιστήρ recorded on *Lists*;²⁹⁴ or it may simply be another term for stylus.

Simple Spoon

The tracts of the Empire dealing with pharmacy are replete with references to the *kochliarion* (κοχλιαρίον). The sources show clearly that *kochliarion* designated both a physical object and a unit of measure. The object itself is not described but, as it is linked with the spoon probe and liquid applications, it surely was a spoon/scoop. We may again cite Galen:

Let the application be made by a spoon (*kochliarion*) or by a spoon of a probe.²⁹⁵

What we would call spoons, i.e. round, oval or oblong bowls—some quite fashionable—mounted on handles, only surface occasionally in instrumentaria.²⁹⁶ The reason for their infrequent occurrence may be the common presence of the spoon-probe, which, of course, although different in shape, was a spoon

290 *Simples* 12.323K; *Doctrines Hipp. and Plat.* 1.5.13 (De Lacy) = 5.184K; followed closely or copied by Aëtius (2.183.14; 8.10.21).

291 Künzl (1983a) 46(13.4); 47(15.9 converted into a retractor); 110 Moesia Sup. 2, 113(88.1); 116 Pannon. 1; 121 Raetia 5.

292 *Kalamos* (reed) also occurs if seldom; e.g., Aëtius cuts up fried goat's blood used as a medicine against stone καλάμῳ ὀξεῖ (11.12.9). *Kalamos*, sometimes modified by the adjective γραφικός or γραφής (Pollux 10.61), can mean reed pen, as at Plutarch, *Life of Demosthenes* 29.3. Conceivably a simple reed pen might sometimes lie behind the term γραφεῖον in Galen and elsewhere.

293 As, e.g., Paul 6.51.2; 6.66.2.

294 Schoene (1903) 281; Bliquez (1984) 198; Fischer (1987) 35(13).

295 In Aëtius 8.43.31: ἐμβεβλήσθω δὲ κοχλιαρίῳ ἢ κυαθίσκῳ μήλης τὸ προσαγόμενον.

296 Künzl (1983a) 46(13.3), 77(51.27); Jackson, 1986 130(32), 158 and Pl. XI.

nonetheless and, therefore, could be used in the same way. Also found now and again in instrumentaria are small round or oblong spoons/scoops, often set at an angle to the shafts on which they are mounted (Fig. 29.30–32).²⁹⁷ These nowadays go by the Latin name *ligula*, ear probes, and the like, as noted above (Spoon Probes). Very likely the term *kochliarion* could cover the *ligula* and ear probe/spoon as well as the specimens resembling contemporary spoons, as shown in Fig. 3, 6th from left.

References to *kochliarion* as a unit of measure now and again seem to reflect the physical size of the spoon in use. So, we can at least know that it varied in size from small to large and in between.²⁹⁸ Once Galen recommends a *kochliarion* that is “oblique/vertical/perpendicular as opposed to straight at its terminus.”²⁹⁹ By this he would seem to refer to the spoon/scoop of a *ligula*, which, as noted above, sometimes veers off at an angle from the shaft.

All Greco-Roman medicinal spoons/scoops were handy for the preparation (mixing/stirring, heating) and application of medicaments. In some cases the patient might swallow/lick the medication with/from the spoon,³⁰⁰ in others a physician might apply medications gently or with pressure, as against the uvula and, perhaps, distill them, as into the nostrils.³⁰¹ The use of the ear probe/spoon for cleaning the auditory canal of cerumen and foreign objects and the possible deployment of the *ligula* as a cautery are discussed above under Spoon Probes.

297 E.g., Künzl (1983a): 47(16.24, 30–35), 99(79); Jackson (1986) 128(28, 29) and Pl. XI; Bliquez, Jackson (1994) 84 and 156(189) from Casa del Medico Nuovo (II).

298 Cf., e.g., Galen, *Maintaining Health* 6.271K: τὸ δὲ πλήθος ἐκάστης δόσεως ἔστω κοχλιάριον μεστόν, μικρόν μὲν ἐπὶ τῶν μικρῶν σωμάτων, μέγιστον δὲ ἐπὶ τῶν μεγίστων, ἀνὰ λόγον δ' ἐπὶ τῶν μεταξύ); *Meth. of Healing* 10.516K = H-J 2.324–325; *Compds. by Place* 13.47K (... δόσις ... δυοῖν κοχλιαρίων ἀξιολόγων τὸ μέγεθος).

299 *Compds. by Place*, 12.962K ἐμβεβλήσθω δὲ κοχλιαρίῳ λειοῦμενα τὰ ξηρὰ φάρμακα καὶ βέλτιον, εἰ κατὰ τὸ πέρας εἰς ἐγκαρσίαν τομὴν ἢ εὐθείαν εἴη τελευτῶν τὸ κοχλιάριον.

300 Aëtius 3.131.7 ἔψε (hellebore) ἕως μελιτώδους συστάσεως καὶ δίδου κοχλιάριον μέγα ἐκλείχειν; 8.58.59 παρέχων κοχλιάριον ἐκλείχειν τῷ δακτύλῳ; 9.12.32, 47 & 75 εἴτα κοχλιαρίῳ καταρροφεῖτωσαν κατὰ βραχὺ καὶ ἐκ διαστημάτων [Philumenus].

301 Galen via Aëtius 8.43.26–32 (diseased uvula): καλῶς <δὲ> ποιεῖ ἐπ' αὐτῶν καὶ ἀνάθλιψις διὰ κοχλιαρίου ψυχρότατον ὕδωρ ἔχοντος—καὶ ξηροῖς δὲ λειωθεῖσι προσάπτεσθαι χρὴ τοῦ γαργαραῖνος, ἀτρέμα πῶς ἀνάγοντα πρὸς τε τὴν ἄνω χώραν καὶ τὴν ἐκτός, ὡς ἐπὶ τὴν γλῶτταν. ἐμβεβλήσθω δὲ κοχλιαρίῳ ἢ κυαθίσκῳ μήλης τὸ προσαγόμενον... Galen, *Compds. by Place* 12.983K (diseased uvula [Apollonius]): πλήρου κοχλιάριον καὶ πρόσφερε τῇ σταφυλῇ, 12.944K (the same): διὰ κοχλιαρίου προσαπτόμενον μετὰ τοῦ ἀναπιέζειν. At *Compds. by Place*, 13.233K, a spoonful of vinegar is given as a sternutatory for jaundice διὰ τῶν μυκτῆρων ἀνέλκειν. This could mean that the vinegar was administered by a small spoon-probe, *ligula* or the like.

Spoon (?) for Application of Gargle to Uvula

Paul treats inflamed uvula with an astringent gargle, such as pomegranate juice, “applied with a spoon or the instrument called the *staphulepartes*/σταφυλεπάρτης.”³⁰² Because the -επαρτης element of the compound seems derived from ἐπαίρω (meaning ‘to raise, elevate’) the Liddell-Scott Greek Lexicon interprets the *staphulepartes* as being the same as the *staphulagra*, or uvula forceps (see under Forceps). But it is hard to see how the instrument scholars have identified as the *staphulagra* could have been utilized in applying a liquid like pomegranate juice. Since Paul makes the application with a spoon as well, Milne³⁰³ concluded that the *staphulepartes* must, in fact, just be another name for spoon. I favor that view. Even so, that still leaves one puzzled as to why the name of the instrument ends in -επαρτης. Perhaps it was because the ancients felt that the spoon made the uvula ‘raise up’ under the force of its application, or that its medication made the uvula itself ‘raise up’ by returning to normal size.

Strigil

We are familiar with use of the strigil in promoting hygiene, but the medical literature of the Empire records deployment of the strigil (Greek: ξύστρα/*xustra*) to prepare and administer medicine by warming and instilling, as with a spoon, or to stimulate an area by rubbing. To quote one authority, Galen in *Cmpds. by Place* preserves a number of remedies for earache taken from Archigenes; among them:

Grind up white hellebore with rose oil and instill it warm with a *xustra* . . . or boil down a sloughed skin of a snake with poppy capsules and instill . . . or warm the fat of a squirrel in a *xustra* and instill it.³⁰⁴

In Aëtius we find a depilatory of tithymalus, wine and oil applied before a sweat and then removed by a *xustra* along with the hair.³⁰⁵

302 κιονίδος φλεγμαινούσης γαργαρίσμασι χρηστέον τοῖς ἐπὶ παρισθμίων φλεγμονῆς καὶ τοῖς μετρίως στύφουσιν, οἷός ἐστι ρόας χυλὸς διὰ κοχλιαρίου ἢ τοῦ ὀργάνου τοῦ σταφυλεπάρτου λεγομένου ὑποτιθέμενος . . . (3.26.16).

303 (1907) 89.

304 12.622–624K: ἢ ἐλλέβορον λευκὸν λεάνας σὺν ῥοδίνῳ, χλιαρὸν διὰ ξύστρας ἐνσταξε . . . ἢ μετὰ κωδυῶν μήκονος ἀφέψει καὶ ἔγχει τὸ τοῦ ὀφθαλμοῦ γήρας . . . ἢ σκούρου στέαρ, ἐν ξύστρᾳ χλιαίνων ἐνσταξε. Cf. also for earache: Celsus 6.7.1C; Pseudo-Galen, *Drugs Easily Procured* 14.403K; Scribonius Largus, *Comp.* 39 and 41 (*calidum [med.] per strigilem infunditur*); Marcellus Empiricus, *De Med.* 9.83 et passim.

305 6.63.13–15: . . . ἀναμίξας ἀλειφε ἐν βαλανείῳ καὶ βραχὺ ἰδρώσας, εἶτα περιξύσας εὐρήσεις τὰς τρίχας ἐν τῇ ξύστρᾳ.

Vigorous stimulation of the cheeks with a sharp edged strigil (*strigili non obtuso*) is recommended by Caelius Aurelianus for toothache (*Chron. Diseases* 2.4.78). The same authority advises a similar treatment of the abdomen for diseases of colon (*strigilis rasio adhibenda: Chron. Diseases* 4.7.102). Again Agathinus, in his discussion of hot and cold bathing for the sick, reddens the patient with “not very dull strigils.”³⁰⁶

In addition to the desirability of sharper edged strigils, we also find that sometimes iron models are required, as for earache in Marcellus Empiricus, *De Med.* 9.83 (*oleum laurinum strigili ferreae inditum atque ita callefactum . . .*).

For administration of drugs smaller types may have been preferable. Several found in Pompeii can be taken to represent such, though neither can be linked with surgery.³⁰⁷

The presence of strigils in instrumentaria taken from graves supports the literary testimonia.³⁰⁸

Needles

Eyed Needles

Eyed needles of copper alloy occur not infrequently in surviving instrumentaria.³⁰⁹ These may be curved or straight (Fig. 84, 2nd from rt.). The names used to designate them in Imperial surgical tracts are, βελόνη (*belone*) in Greek, and *acus* in Latin. The Hippocratic terms ἀκίς (*akis*) and ῥαφίς/-ιον (*rhapsis/-ion*) rarely occur in the sense of surgical needle, though they reemerge on *Lists*.³¹⁰ The eye of the needle is called in Greek κύαρ, οὖς, τρήμα,

306 In Oribasius, *Coll. Med.* 10.7.25 [Agathinus]:...ξύστραις μὴ πάνυ ἀμβλείαις ἐπὶ πολὺ δὴ ξύοντας φοινίσσειν τὸ σωμάτιον.

307 Bliquez, Jackson (1984) 69–70(317–318).

308 Künzl (1983a) 8–9 lists 4 graves, providing illustrations on pp. 93(73), 105(84), & 113(88.2). We may now add a fine specimen recovered in the Domus ‘del Chirurgo’, Rimini (us. 217: personal communication from Ralph Jackson).

309 E.g., Künzl (1983a) 42(11.10) Kallion; 94(75.9–10) Nijmegen; 105(84) Morlungo. See also Bliquez, Jackson (1994) 165(219) and Künzl (1995) 316(6). Survivals of bone or ivory, though abundant, seem not to occur in surgical kits, nor do specimens of iron. Any of the latter will have likely disintegrated. For eyeless iron/steel models for eyework mounted on copper alloy shafts, see below.

310 Schöne (1903) 281, 283; Bliquez (1984) 198, 202. Paul (3.59.9) once tests for hemorrhoids ῥαφίδι and Galen once glosses the Hippocratic ῥαφίω as κεντηρίω in his *Hippocratic Glossary* (19.134K). There he clearly has an ordinary household article in mind: ῥαφίω: τῷ κεντηρίῳ, ᾧ διακεντοῦντες οἱ τεχνῖται τῶν τοιούτων ἐπιτηδείους ὁπὰς τῇ τοῦ λίνου διέρσει παρασκευουάζουσι.

and διατρήμα.³¹¹ In addition to being sharp (ὀξεῖα βελόνη, Oribasius, *Syn.* 7.9.1; *Eunap.* 3.23.1) and sharp and fine (βελονῶν ὀξέων τε καὶ λεπτῶν, Galen, *Tremor* 7.637K), needles used for surgery and dissection are described as: fine and extremely fine: βελόνην λεπτὴν (Galen, *Anat. Proc.* 2.427 = 1.219Gar), *tenuis acus* (Celsus 7.7.8B), τῇ λεπτοτάτῃ βελόνῃ (Galen, *Blood in the Arteries* 4.708K), βελόνην ἰσχυροτάτην (Paul, 6.13.1); stout: βελόνην εὖρωστον (Oribasius, *Coll. Med.* 50.11.5); dull: βελόνῃ ῥάμμα ἐνείραντες ἀμβλεία (Oribasius, *Coll. Med.* 45.18.15); bent: βελόνην καμπύλην (Galen, *Anat. Proc.* 2.668K = 11.503Gar); slightly bent at the end: βελόνην . . . ἐπικαμφθεῖσάν τε μικρόν κατὰ τὸ ἄκρον (Paul, 6.18.1); large: βελόνην εὐμεγέθη (Paul, 6.65.3); and fine with a blunt part: καθεὶς βελόνης λεπτῆς τὸ ἀμβλὺ μέρος (Oribasius, *Coll. Med.* 46.11.13). Milne (1907) 75 maintained that only a three cornered needle was of use in suturing tissue and, though he maintained that he had one in his own collection, I know of no such specimen so far that can be authenticated as ancient.

It is obvious that in surgery wounds and incisions would need to be stitched, vessels to be ligated, etc.; so we are not surprised to hear often in the literary sources of stitching and of the material threaded though needles for suturing (νήματα, ῥαφαί, ῥάμματα) and other purposes, such as positioning and ligating: linen (e.g. Paul 6.13.1), wool (e.g. Pseudo-Galen, *Intro. or Physician* 14.791K = Petit 19.16; Paul 6.8.1.34), sinew (Oribasius, *Coll. Med.* 45.24.8), dried gut and silk (Galen, *Meth. Healing* 10.942K = J-H 3.420–421), and even human (Paul 6.13.1) and animal hair (Paul 6.18.1). In general, it seems wool was preferred for suturing/stitching and linen for positioning/ligation.³¹²

In the absence of appropriate adhesives, bandages and splints also had to be stitched into position with needles.

Aside from introducing various types of threading into position for ligating blood vessels or for positioning tissue, blood vessels and even eyelashes for incision, excision, or removal by some other means, needles acted as lancets, probes, retractors, directors, and cauteries. We find several references to the application of medicaments to the skin in conjunction with piercings with a needle, as in Galen's treatment of alopecia:

Anoint alopecia in the sun or by a fire. When a pustule occurs, lance it with a needle. When the pus is drawn off, treat it with cerates (*Cmpds. by Place*, 12.841K [Apius Fascus]; cf. also 13.357K of the same work).³¹³

311 Galen, *Comm. Hipp. Reg. Acute Diseases* 15.914K, *Comm. Hipp. Surgery* 18b.740K, *Hippocratic Glossary*, 19.115K; Paul 6.13.1.

312 See esp. Witt (2009) 112–114.

313 ἔχρει δὲ τὰς μὲν ἄλωπεκίας ἐν ἡλίῳ ἢ παρὰ πυρὶ. φλυκταίνης δὲ γενομένης βελόνῃ χρὴ διακεντεῖν. ὕγρῳ δὲ ἐκκριθέντος κηρωταῖς ἀποθεραπεύειν.

On occasion multiple needles might be deployed at the same time. For medicating the same condition Galen records:

Some binding together needles so as to position the points on the skin have pricked it with them—(*Cmpds. by Place* 12.397 & 415K [Soranus]).³¹⁴

The most daring surgeries involving needles are gastrorrhaphia,³¹⁵ or stitching of an abdominal wound, and correction of various hernias. The following source summary illustrates well the multiple procedures involving needles. A number of them necessitating, e.g., puncturing or cauterizing, were likely performed with the eyeless iron/steel models discussed in the next section.

Suturing/Sewing

Celsus: stitching a wound and a bandage in place (5.26.23D & 24B); suturing margins of surgical wound in correcting lax eyelid (7.7.8F); gastrorrhaphia, or stitching abdominal wall and even the large intestine in event of a wound (7.16.4–5); suturing and ligating abdominal rupture (7.17.1B).

Galen: sewing a bladder to the side of an animal to test movement of air in respiration (*Anat. Proc.* 2.703K = 11.547Gar); gastrorrhaphia or stitching abdominal wall and even the large intestine in event of a wound (*Meth. Healing* 10.416–418K = J-H 2.164–169); sewing linen thread to medicated sponge for nosebleed to facilitate withdrawal (*Cmpds. by Place* 12.692K [Heracleides of Tarentum]); sewing bandages in place (*Comm. Hipp. Surgery* 18b.740–752K).

Oribasius of Pergamon: sewing bandages in place (*Coll. Med.* 48.19.22 [Galen]).

Paul of Aegina: suturing in cases of wounded tendons or sinews (4.54.6); suturing eyelid in plastic operation for trichiasis (6.8.1.33); suturing for male breast reduction (6.46.1); gastrorrhaphia or stitching abdominal wall and even the large intestine in event of a wound (6.52.3–4 [Galen]).

Scribonius Largus: gastrorrhaphia or stitching abdominal wall and even the large intestine in event of a wound (*Comp.* 206).

³¹⁴ ἔνιοι δὲ βελόνας συνδήσαντες, ὥστε τὰς ἀκμὰς ἔχειν ἐπὶ τὸ δέρμα, κατεκέντησαν ταύταις αὐτὸ . . .

³¹⁵ For an exhaustive treatment of this surgery, see Witt (2009).

Lancing/Puncturing

Aëtius of Amida: securing by puncture the glutinous substance of a snail for medication to glue in proper place ingrown eyelashes (7.70.4 = Hirschberg, Waugh pp. 104–105. Chp. 70); puncturing skin to apply medication to create or remove a tattoo (8.12.79–95); lancing pustules arising from application of medication for alopecia (8.16.144); puncturing lozenges in preparation of unguent (16.126.15).

Cassius Felix: puncture to diagnose and treat leuke = leprosy or elephantiasis? (8.2).

Celsus: lancing pustules arising from erysipelas (5.28.4D); puncturing skin to test for type of psoriasis (5.28.19C); puncturing hemorrhoids after application of caustics (6.18.9C); retracting clavi or small tumors on eyeball for excision (7.7.12).

Galen of Pergamon: puncturing artery in anatomical exploration (*Blood in the Arteries* 4.708K, et passim); puncturing to administer medicine in treating alopecia, mentagra and gout (*Cmpds. by Place* 12.397, 415, 841, and 13.357K [Erasistratus of Sicyon]); puncturing pustules (*Comm. on Hipp. Fractures* 18b.599K); puncturing of heart in anatomical exploration (*Opinions of Hippocrates and Plato* 1.5.13 = Delacy p. 79).

Oribasius of Pergamon: puncturing skin to apply medication to remove a tattoo (*Syn.* 3.36.3); lancing pustules/blisters (*Syn.* 7.9.1 = *Eunap.* 3.23.1).

Paul of Aegina: testing hemorrhoids for application of medicament (3.59.9.17); puncture to diagnose and treat leuke = leprosy or elephantiasis? (4.5.1&3 [Archigenes]); pricking skin in conjunction with application of medication to remove a tattoo (4.7.1 [Crito]); lancing pustules arising from various conditions (4.10.1).

Dissecting

Galen of Pergamon: dissecting muscles of mouth by raising tissue with loops of thread inserted by needle (*Anat. Proc.* 2.427K = 1.219Gar).

Paul of Aegina: separating eyelid hairs from sutures in plastic operation for trichiasis (6.8.1.38).

Probing

Oribasius of Pergamon: measuring depth of trephine track (*Coll. Med.* 46.11.13).

As a Block/Director for Scalpel

Aëtius of Amida: treating ectropion or eversion of lower eyelid (7.74.19–25 [Demosthenes and Antyllus] = Hirschberg, Waugh pp. 110–111. Chp. 74).

Paul of Aegina: treating ectropion or eversion of lower eyelid (6.12.1).

Cauterizing

Celsus: to eliminate irritating eyelashes (7.7.8B); to correct ectropion or everted eyelid (7.7.10, where *tenui ferramento* is likely a needle); to close ear piercings (7.8.3). N.B. The needle used in these cases is probably the type discussed below under Needles for Cataract Surgery, etc.

Threading for Retraction

Aëtius of Amida: of eyelid with thread for plastic operation for trichiasis (7.71.54 [Leonides] = Hirschberg, Waugh pp. 106–107. Chp. 71); of pterygium with linen thread to saw the growth off with a horse hair (7.62.5 = Hirschberg, Waugh pp. 96–97. Chp. 62).

Celsus: of pterygium with linen thread for sawing with horsehair (7.7.4B); anabrochismos or drawing outward irritating eyelashes with a woman's hair (7.7.8C, though he disapproves).

Pseudo-Galen: anabrochismos or drawing outward irritating eyelashes (*Intro. or Physician* 14.784K = Petit 19.6).

Paul of Aegina: of eyelid with thread for plastic operation for trichiasis (6.8.1); anabrochismos or drawing outward irritating eyelashes with woman's hair or linen thread (6.13.1); of pterygium with linen thread to saw off the growth with a horse hair (6.18.1).

Threading for Ligation or Other Purposes

Aëtius of Amida: ligate and strangle staphyloma (7.37.2–28 = Hirschberg, Waugh pp. 56–57. Chp. 37); encanthis (7.64.3 = Hirschber-Waugh pp. 98–99. Chp. 64); ligation and division of temporal blood vessels for migraine-like condition (7.95.13–14).

Celsus: to strangle and excise staphyloma (7.7.11); to strangle exomphalus or navel hernia as in staphyloma of eye (7.14.5); to strangle abdominal rupture as in staphyloma and navel hernia (7.17.1B); ligating to mortify exposed portion of omentum (7.21.1B); ligating scrotal varix = cirsocele (7.22.3–4); ligation of foreskin to promote infibulation (7.25.2); to strangle condylomata [described as anal tumors caused by inflation] with linen thread (7.30.3B).

Galen: stretching a nerve with linen thread in anatomical operations (*Anat. Proc.* 2.427 = 1.219Gar, et passim); strangling papillary growths of trichiasis and hemorrhoids with thick thread of greasy sheep wool (*Comm. Hipp. Reg. Acute Diseases* 15.914K).

Pseudo-Galen: to ligate and strangle exomphalos with linen thread (*Intro. or Physician* 14.786K = Petit 19.11).

Oribasius of Pergamon: to raise a varicose vein with a thread (*Coll. Med.* 45.18.15); to ligate aneurysm (*Coll. Med.* 45.24.4–9 [Antyllus]); to prepare perforations for infibulation/krikosis (*Coll. Med.* 50.11.5).

Paul of Aegina: for ligation with raw flax and division of temporal blood vessels for migraine-like condition (6.5.1); ligate and strangle staphyloma (6.19.1); for aneurysm (6.37.2–3); to ligate and strangle navel hernia/exomphalos (6.51.2); binding scrotal varices in operating for cirsocele (6.64.2 [Leonides]); binding the peritoneum in operating for enterocele (6.65.3); ligating varicose veins (6.82.1).

Needles for Cataract Surgery and Other Eye Conditions

When the crystalline lens of the eye becomes opaque, the result is a cataract (Greek ὑπόχυμα, γλᾶύκωμα; Latin *suffusio*). The operation for depressing or ‘couching’ cataracts is first described in Celsus, who offers an extensive account (7.7.14).³¹⁶ There is no surgical treatment for cataracts in the *Hippocratic*

316 The term ‘couch’ derives from the French ‘coucher.’ Zipser-Fischer (2004) 11 provide most of the verb forms used to express ‘couch’ in Greek and Latin: παρακεντέω, κατάγω, καταφέρω, καταβιβάζω, *parakentizo* and *depono*. Celsus uses *deduco* and *imprimo*.

Corpus, leading scholars to speculate on the time and circumstances of its emergence. It has been noted that the procedure for couching was practiced in India before we hear about it in Celsus.³¹⁷ This prompts speculation that it reached the Mediterranean via Alexander's eastern expedition, or that it arose in the medical ferment of Hellenistic Alexandria. Whatever its origins, the operation was surely known by the third century BCE when the stoic philosopher Chrysippus (ca. 280–207 BCE) remarks on it.³¹⁸

To dwell on the essentials: Celsus directs the surgeon to insert a needle midway between the pupil and the angle of the outer canthus, raise it up to engage the cataract, then depress the latter into the space (vitreous gel) below the pupil. If the cataract remains there, well and good. If, however, it returns to its original position, then it should be broken up with the same needle. If the left eye is the focus of the operation, the surgeon should use his right hand; if the right eye, then his left hand should be employed. Celsus merely calls the instrument employed *acus*, the name for an ordinary household needle. This, he says, should be “sharp enough to pierce but not too slender” (*acus admouenda est, sic <ac>uta, ut foret, non nimium tenuis*; 7.7.14D).³¹⁹

The other extensive account comes from Paul (6.21) who depends on Galen. Here we find the same basic procedure. But Paul also gives a technical name for the needle. Unfortunately the manuscripts give variant spellings for this instrument, these ranging from παρακεντητήριον/*parakenteterion* (preferred by Heiberg) to παρακεντήριον/*parakenterion* and κεντήριον/*kenterion* (preferred by Briau and Milne).³²⁰ None of these names is found in the preserved text of Galen, though we once find there παρακέντριον (*Comm. Hipp. Surgery* 18b.672K) which, if not a corruption, is yet another spelling. Other variants occur on *Lists*.³²¹

317 Majno (1975) 311, 378–9.

318 von Arnim (1903) 178.5.

319 For further details, especially on ancient misunderstanding of the anatomy of the eye, see Jackson (1996) 2248–2250.

320 I do not have access to Briau, only to Milne's translated text (p. 70), which depends on Briau's edition.

321 There we find παρακεντήριος, *parakenteter* (Schoene [1903] 283) in addition to παρακεντίδες and *paracentitiri/eri* (Fischer, 1987, 32[5]; see also *Mulomedicina Chironis* 74). Galen may also have called the cataract needle κέντιον or κέντριον (Galen, *Cmpds. by Kind* 13.407K). On another occasion he uses the simple term τὸ καθιέμενον ὄργανον to designate the tool (*Usefulness of the Parts of the Body* 3.781K, with May's translation p. 476). J. Lascaratos (*Med. Sec. Ns.* 11.2 [1999] 402) claims κεντητήριον in the *Life of St. Thecla* but I find only σιδήριον. He and Spyros Marketos give details of the operation in *The Cataract Operation in Ancient Greece*, xxviiith International Congress for History of Medicine Proceedings, vol. ii (no page nos.).

If, for convenience, we settle on *parakenterion*, Paul (6.21.2) adds that it was rounded at its point (ἀντιστρέψαντες τὴν ἀκμὴν στρογγύλην κατὰ τὸ πέρας ὑπάρχουσαν τοῦ παρακεντηρίου) while mounting at the other end the *puren* so familiar on probes. The purpose of the latter was to measure off and mark the point for insertion between the pupil and the outer canthus. Celsus, it will be remembered, makes the insertion midway between these two points, but he refers to no measuring device in this regard.

Surviving instrumentaria provide various needles which answer well to the details provided in the literary sources.

One type, which coincides exactly with Paul's specifications, is exemplified by a splendid set of five instruments packed in one of the common cylindrical carrying cases for instruments and medicaments (Fig. 30). These were dredged from the River Saône (Montbellet) and are now housed in the Musée Greuze, Tournus (France).³²² Each consists of a needle mounted on a shaft terminating at the other end with the *puren*. The instruments are all of copper alloy. Four of them are beautifully decorated along the shaft with a spiral silver inlay. Two of the needles are unusual in being hollow with retractable stems (as shown by the drawn version on Fig. 31). No surviving Greco-Roman literary source mentions this type, but Dr. Ursula Weisser has noted that such a needle is attributed to the Greeks in Arab sources as being designed for removing the cataract by sucking it out.³²³ This is a remarkable instance of the Arabs shedding light on an instrument of surgery recovered in a Roman context. In addition to those dredged from the Saône, one can cite similar, though not hollow (insofar as I know) examples from: Kallion (Achaia), Pompeii (four in all, one being Fig. 84, 2nd from left), Viminacium (Serbia), Termes (Spain), Maaseik (Belgium), Asia Minor, and an unknown site in Italy (Fig. 3, middle row, 11th from rt.).³²⁴

A second type, many examples of which survive, admits of several subclasses. One of these, itself admitting of variations, is best represented by the famous instrumentarium excavated at Rheims and now in St. Germain-en-Laye. Here we find six squatty cylinders, four round and two hexagonal, each with a round socket for pegging in an iron/steel instrument.³²⁵ Two similar cylinders in the ensemble are equipped, in addition, with slots for blades at

322 For a full account, see Feugère, Künzl, Weisser (1985).

323 *Ibid.* 482–507.

324 Künzl (1983a) 42(11.9); Bliquez, Jackson (1994) 165(127); also 203(A10), 209(A35), 88 and Pl. xxiii (a). See in addition Korac' (1986) as reported by Kirova (2002) 90; Feugère, Künzl, Weisser (1985) Taf. 59(2 & 3) and Taf. 60(2a); Jackson 1986 126(23).

325 Künzl (1983a) 66(37.32–35 round; 36 and 39 hexagonal).

one terminus (Fig. 32, middle specimen).³²⁶ Finally, one unique piece mounts the familiar *puren* opposite the socket (Fig. 32, lower specimen). The steel/iron inserts are now missing on all of these instruments, the only evidence of their estwhile existence being a smudge of rust. This is truly unfortunate because similar specimens with round sockets recently recovered at Rimini mount a blade not a needle in their sockets.³²⁷ This means we cannot be sure, as we once were, that such socketed handles always supported needles.³²⁸

Also to be included in this socketed class is a type that usually features two iron/steel needles, one at each end of a slender socketed shaft. Over a dozen are recorded as having been recovered in Pompeii and lately one at Alliano (Baykan [2012] cover and 137.263); to these we may add examples come upon in surgical graves at Colophon, Bingen, Nijmegen (Fig. 89, ensemble lower right), Tomis/Constanza, Savaria/Szombathely, and Italy (Fig. 3, 10th from rt.).³²⁹

In the main, the shaft of this type is decorated with a combination of striation, molded rings and fine and broad lattice patterns. Frequently, one of the socketed ends is positioned at an angle to the shaft. With one exception the iron/steel needles are missing, the exception being a specimen in Naples still faintly preserving its insert, which is now turned back and twisted around the shaft.³³⁰ Though the majority of the Pompeian specimens cannot be traced to surgical contexts,³³¹ four have been found with surgical tools: one in the Villa di Giulia Felice, one in the House of M. Velusius Iuvencus, one in the Palaestra/Piazzale Anfiteatro³³² and an unprovenanced Pompeian specimen recovered along with an elevator.³³³ Another, traced to the Casa del Medico Nuovo (11) combines a needle socket and a sharp retractor (Fig. 42; Fig. 84, 4th from rt.), as do three similar pieces, one from Cyzicus (Fig. 83, lower row left), one from

326 Künzl (1983a) 66(37.37–38); for a similar specimen taken from the sea off Syracuse see Gibbins (1989) 11.

327 See Jackson (2003) 316.

328 Minchev (1983) 145(7 & 8) claimed two handled needle holders with décor for Marcianopolis. A subsequent treatment of this instrumentarium illustrates them. See Kirova (2002) 90–91 and Fig. 13. She also considers Minchev 146(23), which she does not picture, as a possibility. These needles, if that is what they are, may belong in this class.

329 Caton (1914) 117(xi) with Pl. XI (28); Künzl (1983a) 83(57.20), 94(7.13), 111(87.2–3), 117(92.5); Jackson (1986) 126(24).

330 Bliquez, Jackson (1994) 165(227).

331 For the unprovenanced specimens see Bliquez, Jackson (1994) 165–6 (221–30).

332 Bliquez, Jackson (1994) 202(A2), 204(Ag), Pl. XXIII(a).

333 Bliquez, Jackson (1994) 206(A18).

Rimini and one from London.³³⁴ One specimen, recovered from a grave on Melos, is mounted on a forceps with pointed jaws (Fig. 33).

Finally, a seldom come upon third type, all of copper alloy, mounts two needles on a robust shaft (Fig. 20, 5th from left).³³⁵ In this case the shaft is decorated with a 'knotty limb' motif, which is suggestive both of the staff of Asclepius and the club of Hercules.³³⁶

In addition to dealing with cataracts, all of these needle types will have been useful for probing, fine dissecting and cauterizing. In fact, they were likely employed far more often in these operations than in cataract surgery. Owing to their very nature, they seem especially well suited to delicate operations around the eyes. For example, when Celsus cauterizes offending eyelashes with "a fine iron needle, broad like a lance/javelin," one thinks of the types with sockets for iron/steel needles.³³⁷ Further links to eye surgery are suggested by those specimens in this same category that do not have two needles but terminate at one end in a probe, a forceps (Fig. 33), or a sharp hook (Fig. 42).³³⁸ The latter feature fits well with several literary testimonia to deployment of the sharp hook in ophthalmic procedures, such as raising pterygium and encanthis for excision.³³⁹

Trocar?

It is uncertain whether the trocar, a combination needle-tube for puncturing and draining in the process called paracentesis, was available to the Greco-Roman surgeon. Dropsy and empyema, conditions for which a trocar will have been handy, were being treated from the time of the Hippocratics. A trocar-like instrument has long been known in the Meyer-Steinig collection (Fig. 34). The problem is that recent critical examination of the collection has resulted in some question as to the dating of a number of pieces, the so-called trocar among them.³⁴⁰ On the other hand Galen refers to contemporary treatment of dropsy by paracentesis³⁴¹ and records, likewise, that sharp tools were used

334 Bliquez, Jackson (1994) 128(81). For Cyzicus see Heres (1992) 162; for Rimini and London see Jackson (2003) 317 and Jackson (2008b) 194–196, Fig. 4.4.1, no.4.

335 I know of only three examples; see Bliquez (1998) 88–89.

336 Bliquez (1992) 35–51; Bliquez, Jackson (1994) 99–106.

337 7.7.8B: *tenuis acus ferrea ad similitudinem hastae lata in ignem coicienda est*—.

338 For the forceps/needle from Melos, see Künzl (1983a) 41(10.1).

339 Celsus 7.7.4B (pterygium) and 7.7.5 (encanthis); Paul 6.8.1 (suture of eyelid in trichiasis); 6.15.1 (adhesions); 6.18.1 (pterygium).

340 Künzl (1991a) 48–49(33), Künzl (1991aa) 1 533(33).

341 *Comm. Hipp. Aph.* 18a.39K: ἐπὶ δὲ τῶν ὑδρωπικῶν αἱ παρακεντήσεις ὀνομαζόμεναι μᾶλλον τῶν καύσεων ἐν ἔθει τοῖς ἰατροῖς εἰσίν.

for the purpose.³⁴² Unfortunately he does not go into detail. If we consider as analogous to the trocar the *puoulkos* (see under Tubes), which likewise is made up of a tube through which an element is passed (a plunger as opposed to a needle in this case) and that there survives only one example of the *puoulkos*, I do not think the existence of the trocar can be excluded for the Empire, notwithstanding the nebulous status of the Meyer-Steineg instrument.

Cauteries

Another extremely common heavy-duty instrument of surgery was the cautery. The Pseudo-Galenic work, *Introduction or Physician*, gives a succinct synopsis of the conditions for which it might be deployed:

We burn with cauteries, especially for all ulcerations, rheumy eyes, sciatica or even internal conditions. For example, they are applied for wasting and splenetic diseases, for shoulder dislocations, for lacrimal fistula (aegilops), for gangrene, or for blood vessels that are being opened during amputation and for other hemorrhagic situations. (14.782K = Petit 19.2).³⁴³

Like the scalpel, the cautery is frequently mentioned in surgical texts. In fact the two instruments or the surgical acts of cutting and burning are regularly mentioned together, as in the famous Hippocratic aphorism, which makes cauterization the most radical intervention of all:

As many conditions as drugs do not cure, a knife cures; as many as a knife does not cure, fire cures; as many as fire does not cure, these have to be considered incurable. (*Aphorisms* 4.7.87L).³⁴⁴

342 See, *Shoulder Dislocation in Ways not Seen by Hipp.* 18a.376K. There Galen contrasts instruments featuring the *puren* with those, ὧν οὐκ ἔστι περιφερὲς τὸ πέρασ, ἀλλ' ὀξύτερόν περ ἐμπλήρωμα(?) παραπλήσιόν πως τοῖς εἰς τὰς παρακεντήσεις ἐπιτηδεύοις ὀργάνοις. The presence of the nonsensical ἐμπλήρωμα is dubious but the general sense seems clear. Celsus, is no more informative in his treatment of dropsy at 7.14.4, even if one accepts Marx' restoration *vel acu perforato*.

343 καύσει δὲ τῇ διὰ καυτήρων χρώμεθα, ἰδίως μὲν ἐπὶ τῶν νεμομένων ἥδη πάντων καὶ ἐπὶ τῶν ῥευματιζομένων ὀφθαλμῶν, ἰσχίων, ἥ καὶ τῶν ἐντός. καὶ γὰρ ἐπὶ φθισικῶν παραλαμβάνονται καυστήρες καὶ ἐπὶ σπληνικῶν καὶ ἐπὶ τῶν εἰς μασχάλην μελετησάντων ἐκπίπτειν βραχιόνων καὶ ἐπὶ αἰγίλωπος καὶ ἐπὶ τῶν μελαινομένων ἢ πριζομένων διὰ τὰ ἀναστομούμενα ἀγγεῖα καὶ ἐπὶ τῶν ἄλλως αἰμορράγοντων.

344 'Οκόσα φάρμακα οὐκ ἰῆται, σίδηρος ἰῆται· ὅσα σίδηρος οὐκ ἰῆται, πῦρ ἰῆται· ὅσα δὲ πῦρ οὐκ ἰῆται, ταῦτα χρὴ νομίζειν ἀνίατα.

The tendency to resort to the cautery as a last measure can be seen in a number of authors, Celsus in particular.³⁴⁵ He underlines the fact that burnt tissue heals more slowly than incised tissue, which explains why.³⁴⁶ There was less hesitation when the area to be treated and the cautery to be used were small, as in eyework.

The usual name given the instrument in the *Hippocratic Corpus* is σιδήριον (*siderion*) and on a few occasions σίδηρος.³⁴⁷ Καυτήρ (*kauter*) and καυτήριον (*kauterion*), sometimes modified by σίδηρος/ον, are standard in the Greek sources of Roman date, with occasional references to καυστήρ, its diminutive καυστήριον, and even καυτηρία.³⁴⁸ Galen in his *Hippocratic Glossary* once gives καυτηρίδιον in defining an Hippocratic term (19.111K). Terms used to designate the cautery in Latin are *ferrum*, *ferramentum* and, borrowing from the Greek, *cauter* and *cauterium*.³⁴⁹ As with the scalpel, we find (once) the tip of the instrument called τὸ ἄκρον (Oribasius, *Coll. Med.* 44.20.41) and its handle λαβή (Galen, *Simples* 12.267K).

The emphasis on iron in the names for the cautery (*siderion*, *ferrum*) indicates that it was most frequently composed of that material. Another such indicator is the occasional specification that a cautery be of copper alloy, showing this to be the exception as opposed to the rule.³⁵⁰ Iron as the basic material is doubtless one reason why an instrument so frequently cited in the literature survives in such limited numbers and why many of the surviving cauteries are of copper alloy.³⁵¹ A second factor to consider is that other instruments in

345 Jackson (1986) 154–155 cites and discusses relevant passages.

346 *quod per ignem divisum est, minus celeriter coit* (7.15.1).

347 Both forms occur within a few lines in *Haemorrhoids* 5P.

348 καυτήριον σιδηρόν (Oribasius, *Syn.* 8.12.3; Aëtius 12.1.208 [Archigenes]; Paul. 5.3.3.12, 6.50.3, 6.77.2); καυστήριον σιδηρόν (Aëtius 15.11.14); καυτηρία (*Hippiat. Cantabrig.* 80.21.8). A peculiarity is <καυ>τηριακῶ ὄργάνῳ in *Hippiat. Cantabrig.* 100.8.12.

349 Because Celsus designates both scalpel and cautery by *ferrum* he distinguishes the latter by additional phraseology such as *ad ustionem*, *per ignem* and verbs of burning. There are references in the *Hippiatrica* to the cautery as ἡ ῥάβδος: cf. *Ber.* 32.3.6–11, ἡ ῥάβδος τοῦ καυτηρίου (liver pain) and *Ber.* 96.1.5–13, ῥάβδοι μακραί, where we also find γόμφοι ὀρθοί or ‘bolt-like’ types for general application. For cauter, see Palladius: (*Opus Agri.* [Rodgers] pp. 47.3 & 48.15).

350 E.g., *Hippiat. Ber.* 77.1.7–8: καυτηριάζειν . . . χαλκοῖς καὶ μὴ σιδηροῖς ὄργανοις. There are rare references to silver and gold in Theodorus Priscianus, *Euporiston* 2 (*Logicus*) 22(64): *virgulam auri vel argenti ignefactam loco sanguinanti suppono*. There is mention of a squared model of lead to treat nasal polyp in *Mulomedicina Chironis* 551: *cauterium plumbeum . . . quadratum*.

351 Traces of iron cauteries may remain. While working in the Naples Museum in 1985, I noticed that many surgical tools of copper alloy had lumps of iron on their surfaces; e.g.,

the arsenal, such as scalpels and cataract needles with their iron/steel components, could also be utilized for cauterization; to these we may add spatulas, the *puren* on probes, the common *ligula* with its long shaft and flat, round offset spoon/disk, or even the stylus.³⁵² To illustrate, Soranus advises against cauterizing a hemorrhaging umbilical cord with the flat (= spatula) of a probe, an indication that some did.³⁵³ And several times we find what appears to be the dissector of a scalpel employed by veterinarians in a cauterizing procedure.³⁵⁴ A number of spatulas contained in surgical instrumentaria have come down with spatulas bent away from their shafts.³⁵⁵ If this arrangement was by design and not the result of accident, these pieces may have served as cauteries. Instruments like these, as opposed to true cauteries, may lie behind many unspecified references to cauterization. We should also allow for improvisation, as appears to be the case, e.g., with the cautery passed through a protective tube (see below).

Clearly recognizable surviving cauteries include: a circular specimen in Baltimore from Colophon (Fig. 35), a set of three semi-circular models in the Naples Museum from Pompeii (Fig. 2, middle row, 10th–12th from rt.), a rather similar type combined with a lancet in Mainz from Asia Minor (Fig. 20, 7th from either side), a lunated cautery in Bingen (Fig. 36), and a small spatulate model in the British Museum said to be from Italy (Fig. 3, bottom row, above stylus).³⁵⁶ One of the pieces in Naples is of iron as are those in Mainz, the British Museum, and Bingen; the others are of copper alloy.³⁵⁷

Bliquez, Jackson (1994) 111(12), 126(71–72), 131(91–92). This residue was not a component of the tools themselves and must, therefore, have been the remnants of iron and steel instruments, such as cauteries and scalpel blades.

352 See Künzl (1983a) 26; Jackson (1986) 128(26), 155.

353 *Gyn.* 2.11.4 Ilberg = 2.6.25–27 BGM: διὰ αὐλοῦ θερμανθέντος ἢ διὰ τοῦ πλατέος τῆς μήλης.

354 *Hippiat., Ex. Lugd.* 35.3, 49.6 & 86.9 respectively for hip dislocation, epilepsy, ophthalmia: καὺσον μετὰ κεφαλῆς σμιλαρίου. Isidore of Seville emphasizes the need for caution in cauterizing horses: *Etymologiae* (Lindsay), 20.16.8 (*De instrumentis equorum*): *cauterium dictum quasi cauturium*... (I owe the reference to K.-D. Fischer).

355 Künzl (1983a) 116(91).

356 For Mainz see Künzl (1983a) 47(15.12); for Bingen see Bliquez (1981b) 219–220; for Colophon see Caton (1914) 117(x); for Pompeii see Bliquez, Jackson (1994) 44–45 and 134(103–104); for the British Museum see Jackson (1986) 128(25). An attractive candidate is a fragment of copper alloy shaped like a spearhead in Oxford, Mississippi (said to be from Pompeii); See Bliquez (1988) 49.

357 The iron model in Naples may now be lost, as I could not find it in 1985; see Bliquez, Jackson (1994) 45.

In addition to metal cauteries of iron and copper alloy, certain types of fungi were used as well as caustic minerals, and even dung (see below).

Cauteries are documented in many different operations but, in general, they performed four principal functions: (a) to staunch bleeding, (b) to eliminate diseased tissue, (c) to open the way to other parts of the body, and (d) to produce counter irritation.³⁵⁸ A harrowing instance of (a) survives in Leonides' description of his surgery for cancer of the breast as recorded by Aëtius (16.44):

I usually operate in cases where the tumors do not extend into the chest. The procedure is as follows. When the patient has been placed on her back, I incise the healthy area of the breast above the tumor and then cauterize the incision until scabs form and the bleeding is stanch. Then I incise again, marking out the area as I cut deeply into the breast, and again I cauterize. I do this quite often, incising and then cauterizing to staunch the bleeding. This way the bleeding is not dangerous. After the excision is complete I again cauterize the entire area until it is desiccated. I apply the cauteries the first and second time to check the bleeding, but the last time, after the tumor has been excised, for the complete cure of the disease. Sometimes it is my practice even to operate without cauterization when a breast tumor is not scrofulous, as I treat the source of the tumor. So when such a condition exists, one can cure it with excision [of the tumor] from the healthy parts of the breast; for the bleeding is not at all excessive in such cases.³⁵⁹

358 See Milne (1907) 116 and, more recently, Jackson (1986) 154 and (1994) 178 for uses of the cautery and its preference in place of cutting instruments in Arabian surgery.

359 ἐγὼ μὲν οὖν ἐπὶ τῶν μὴ συμπεφυκότων τῷ θώρακι καρκινωμάτων, εἴωθα χρῆσθαι τῇ χειρουργίᾳ· ἔστι δὲ ὁ τρόπος τοιοῦτος· τῆς πασχούσης ὑπτίας ἐσχηματισμένης, ὑπὲρ τὸ καρκίνωμα διαιρῶ τὸ μέρος τοῦ μαστοῦ τὸ ὑγιές, καὶ τὸ διηρημένον ὑποκαίω καυστηρίοις, ἕως ὅτου ἐσχαρωθέντων τῶν σωμάτων ἐπισχεθῇ ἡ αἰμορραγία· εἴτα πάλιν τέμνω, περιχαράσσω ἅμα καὶ βαθυτομῶν τὸν μαστόν, καὶ πάλιν τὰ τετμημένα καίω· καὶ πλειστάκις τοῦτο ποιῶ τέμνων καὶ μετὰ ταῦτα καίω πρὸς ἐποχὴν τῆς αἰμορραγίας, καὶ ἔστιν ἀκίνδυνος ἡ αἰμορραγία αὕτη. μετὰ δὲ τὴν τελείαν ἀποκοπὴν πάλιν ἐπικάω τὰ μέρη τὰ ἔλα ἕως ἀναξηρασμοῦ, τὸ μὲν γὰρ πρῶτον καὶ δεῦτερον πρὸς τὴν τῆς αἰμορραγίας ἐποχὴν, ἔσχατον δὲ μετὰ τὴν τελείαν ἀποκοπὴν τὰ καυτήρια προσάγειν πρὸς τὴν τοῦ πάθους ὅλου ἀνασκευὴν· εἴωθα δὲ ποτε καὶ χωρὶς καύσεως ἐνεργεῖν, ὅταν ὄγκος γένηται περὶ τὸν μαστόν χοιρώδης, μελετῶν τὴν τοῦ καρκινώματος γένεσιν. τοιοῦτου τοίνυν ὄντος τοῦ πάθους, ἔξεστιν ἀρκεσθῆναι τῇ ἀπὸ τῶν ὑγιῶν μερῶν ἐκτομῇ τοῦ μαστοῦ, οὐδὲ γὰρ σφοδρὰ γίνεται ἐπὶ τῶν τοιούτων αἰμορραγία. The final sentence could be a comment by Aëtius and not the concluding remark of Leonides. It is unclear what Leonides means by χοιρώδης or 'scrofulous.' Usually the term refers to swollen lymph glands in the neck. It might also be applied to lymph glands by the breast but that seems pretty sophisticated for this period.

In some interventions cauteries acted as stimulants; that is, they were heated but not directly applied to the tissue under treatment.³⁶⁰ In other cases, they served to transfer heat to substances like oil that were in contact with the flesh (Caelius Aurelianus, *Chron. Diseases* 4.7.103; cf. 5.1.14 and 5.1.21 [Followers of Demetrius]), or were wrapped in rags (*involutis cauteribus*) so as to avoid direct contact (Caelius Aurelianus, *Chron. Diseases* 4.7.103; 5.1.21 [Followers of Demetrius]). Sometimes a series of cauteries were prepared and then applied in sequence.³⁶¹

Before application the cautery had to be heated (πεπυρωμένος, πεπυρακτωμένος).³⁶² Generally it was placed in fire until it was white hot, but not infrequently it was heated to a lower temperature.³⁶³ The first condition was described as διάπυρος (Oribasius, *Syn.* 7.20.6), διαφανής (Paul 6.84.1),³⁶⁴ ἀκριβῶς ἐκπεπυρωμένος (Galen, *Simples* 11.415K), ἔμπυρος διαφανής (Aretaeus, *Causes Signs Acute Diseases* (2) 1.13.4), πάνυ πεπυρακτωμένος and ἄγαν πεπυρωμένος (Galen, *Theriac to Piso* 14.280K; Pseudo-Galen, *Intro. or Physician* 14.797K = Petit 20.10), and *candens* and *igneus* (Celsus 7.2.4, Caelius Aurelianus, *Chron. Diseases* 5.1.19). In the second case the cautery was said to be οὐ σφόδρα πεπυρωμένος (Pseudo-Galen, *Intro. or Physician* 14.786K = Petit 19.10) and *tepidus* (Caelius Aurelianus, *Chron. Diseases* 5.1.19).³⁶⁵

Heated metal cauteries had to be carefully applied and were obviously also a hazard to the operating surgeon. For this reason Galen says he wraps their handles in rags, so that they could be safely manipulated.³⁶⁶ Traces of mineralized wood on the specimen in the British Museum shows that a cautery might also be thrust into or come equipped with an insulating handle of wood.³⁶⁷

A tumor that has exhausted its blood supply tends to knot up on itself or 'fungate' and this might account for the use of χοιρώδης. Note that Leonides only excises the tumor, not the entire breast; so too Paul (6.45) following Galen. But Paul says some actually amputate the breast. These practitioners may be the ones lurking behind a reference to mastectomy in the *Physica Plinii Bambergensis* 67.2 (I owe the reference to K.-D. Fischer).

360 E.g., as in the Hippocratic treatise *Hemorrhoids* 5P.

361 Aëtius 7.88.5–10 = Hirschberg, Waugh pp. 126–127. Chp. 88; Paul 6.62.4.

362 E.g., Aëtius 7.88.5 & 7.89.8 = Hirschberg, Waugh pp. 126–129. Chpp. 88–89.

363 Cf. Caelius Aurelianus (*Chron. Diseases* 5.1.19) for temperature variation.

364 Note that Erotian equates διάπυρος and διαφανής: *Hippocratic Glossary* 127.17.

365 In *Hippiatrica* we also find σκληρός (*Ber.* 20.10.3) and ἐλαφρός (*Ber.* 130.58.6) for intense and tepid.

366 οὕτω καὶ τούτων τὰς λαβὰς ἐνελίττω ῥάκεσιν (*Simples* 12.267K; cf. Aëtius 2.95.19–23).

367 See Jackson (1986) 156.

In a number of instances we hear of a ψηχρός καυτήρ or a cold cautery. This term refers to the use of caustic substances as cauterizing agents and perhaps also to a type of forceps used to apply them (see Forceps, s.v. Caustic Forceps).³⁶⁸

As with cupping vessels, a broad range of terms is used to describe the application of a cautery. Verbs used in Greek to describe their application include: καίω, διακαίω, ἐρείδω, ἐπερείδω, προσφέρω, προσάγω, and ἐμβάλλω. In Latin they are: *figo*, *infigo*, *immitto*, *appono*, *impono*, *aduro* and, in avoiding direct contact, *transcurrere* (Celsus 7.12.6).

I here list conditions treated by cauterization under the term used for cautery

Sideros/on

Aëtius of Amida: burning temples for chronic discharge = rheum from eyes (7.91.4 with disapproval); creating eschars on abdomen in treating bladder ulceration (11.29.86 [Rufus]).

Galen: arresting ulcer/sore/wound (*Comm. Hipp. Epid.* 6, 17b.326K = Wenkebach p. 338).

Paul of Aegina: burning leuke = leprosy/elephantiasis? (4.5.2); burning over stomach for defluxions (6.49.1).

Kauter

Aëtius of Amida: arresting aegilops (7.88.8 = Hirschberg, Waugh pp. 126–127. Chp. 88); burning middle of head for shortness of breath (8.63.195); releasing pus around kidney (11.18.14 [Rufus]); relieving sciatica (12.1.211 [Archigenes]); curing abdominal fistula (16.100.9).

Aretaeus of Cappadocia: penetrating pus pocket on liver (*Causes Signs Acute Diseases* (2) 1.13.4); relieving inveterate headache (*Care Chron. Diseases* 1.2.11).

Caelius Aurelianus: unenthusiastic about burning over or into diseased liver or spleen (*Chron. Diseases* 3.4.57& 66 [Themison]); reddening skin over diseased colon (*Chron. Diseases* 4.7.103); heating water and oil applied for sciatica (*Chron. Diseases*

³⁶⁸ Paul 4.7.3 [Oribasius] for removal of tattoo & 6.87.1 for treating acrochordon; Leon Iatrosophistes *Consp. Med.* 4.8.3&7.14.4 for inflamed uvula and acrochordon.

5.1.14–16); heating, then burning for sciatica (*Chron. Diseases* 5.1.19); heating the hand for sciatica (*Chron. Diseases* 5.1.21).

Cassius Felix: treating bite of rabid dog (67.1).

Leon Iatrosophistes: burning forehead for inveterate headache (*Consp. Med.* 2.2.12); burning indurated spleen (*Consp. Med.* 5.22.6).

Oribasius: arresting gangrene of foreskin (*Coll. Med.* 50.7.4)

Pseudo-Galen: arresting aegilops (*Intro. or Physician* 14.785K = Petit 19.9); arresting spread of venomous bite (*Intro. or Physician* 14.797K = Petit 20.10).

Paul of Aegina: burning spleen for ophthalmia (6.2.2); burning to prevent hemorrhage in treating enterocele (6.65.4); as hemostat in amputation (6.84.1).

Kauterion

Aëtius of Amida: treating bite of mad dog (6.24.40 [Rufus and Posidonius]); burning with *puren* for headache (6.50.20 [Archigenes and Galen]); arresting aegilops (7.88.5 & 10; 7.89.8 = Hirschberg, Waugh pp. 126–129. Chpp. 88–89); cauterizing incised nasal vessel with triangular type to arrest weepy eyes (7.90.13–14 = Hirschberg, Waugh pp. 128–129. Chp. 90); creating eschars on chest in curing empyema (8.73.148); relieving sciatica (12.1.208 [Archigenes]); creating eschars for arthritis (12.25.3–4); as hemostat and to insure eradication of tumor in treating breast cancer (16.41.8 and 16.44.13 [Leonides]).

Caelius Aurelianus: burning small vessels of head for chronic headache/cephalaea (*Chron. Diseases* 1.1.46).

[Dioscorides of Anazarbus]: relieving sciatica (*Euporista or Simples* 1.235.2).

Pseudo-Dioscorides: treating poisonous bites (*Venomous Creatures* [Theriaca] Pr. 131 & 33.6).

Galen: to arrest hemorrhage from mortification (*Meth. Healing* 10.324 & 10.326.K = J-H 2.30–33); closing an ulcer (*Meth. Healing* 10.333K = J-H 2.42–43); extracting venom from poisonous bite (*Meth. Healing* 10.896 = J-H 3.350–351, & *Simples* 12.5K); arresting hemorrhage (*Simples* 11.415K); arresting aegilops (*Cmpds. by Place* 12.822K [Archigenes]); relieving toothache (*Cmpds. by Place* 12.861K [Archigenes]);

arresting oral putrification (*Cmpds. by Place* 12.959K); treating bite of mad dog (*Theriac to Piso* 14.280K).

Oribasius of Pergamon: burning bone corrupted by fistula on palate (*Coll. Med.* 44.20.41–43 [Antyllus, Heliodorus]); arresting mortification of private parts (*Coll. Med.* 44.22.15 [Galen]); hemostat in amputation (*Coll. Med.* 47.13.11 [Archigenes]); as hemostat (*Syn.* 7.20.6 = *Eunap.* 3.36.6); treating bite of mad dog (*Syn.* 8.12.3 = Paul 5.3.3).

Paul of Aegina: arresting hemorrhage (4.53.4); drawing venom from poisonous bite (5.19.4); treating bite of mad dog (Paul 5.3.3); burning armpit to prevent dislocation with slender and oblong types (6.42.1 [Hippocrates]); treating breast cancer (6.45.2); burning over diseased spleen with long type (6.48.1); burning eschars about navel with slender iron types to cure dropsy (6.50.3); as hemostat in correcting imperforate glans penis with slender types (6.54.1); arresting gangrene of foreskin (6.57.1); treating anal fistula with iron types (6.77.2); arresting pterygium about nails (6.85.2); to prevent return of clavus (6.87.1).

Kauster

Aëtius of Amida: burning eschars for joint disease (12.25.7); as hemostat for breast cancer (16.45.8).

Alexander of Tralles: burning of head for flux in chest (*Therap.* 2.209.1).

Leon Iastrosophistes: burning on head for elephantiasis = leprosy? (*Consp. Med.* 5.25.5).

Kausterion

Aëtius of Amida: eliminating kerion/“honey comb” *καυστηρίοις σιδήροις* (15.11.14); as hemostat in breast cancer (16.44.5 [Leonides]); realising pus in case of abdominal rupture (16.100.7).

[Dioscorides of Anazarbus]: Parthian heating treatment for sciatica (*Euporista or Simples* 1.235.4).

Galen: not effective in arresting deep hemorrhage (*Meth. Healing* 10.327K = J-H 2.34–35); arresting spreading ulcer (*Cmpds. by Kind* 13.852K [Eunomus]).

Pseudo-Galen, *Intro. or Physician*: old way of treating empyema (14.744K = Petit 13.28); arresting aegilops (14.785K = Petit 19.9); burning cancer (14.786K = Petit 19.10).

Ferrum/Ferrum Candens

Caelius Aurelianus: burning head for epilepsy *Chron. Diseases* 1.4.143 [Themison]).

Celsus: ulcerating various parts of the body to counter phthisis (3.22.12); burning back of head and neck for epilepsy (3.23.7); arresting hemorrhage from wound (5.26.21C); burning malignant cancer (5.28.2C); burning ulceration arising from therioma/ phagedaena (5.28.3E); burning phymata or little tumors around glans (6.18.2K); burning gangrenous foreskin and penis (6.18.3B & 6.18.4); relieving ulceration of anus (6.18.11); burning blood vessels of temples and head to relieve eyes troubled by thin rheum (7.7.15F); opening blocked ear passage (7.8.2); cauterizing to repair umbilical hernia (7.14.7); burning varix in scrotal skin (7.22.1).

Ferramentum/Ferramentum Candens

Celsus: dripping hot brine with two broad headed *ferramenta* to foment a diseased part (2.17.10); creating ulceration against dropsy/tympanites *ferramentis candentibus* (3.21.10); malarial headache relieved by ulceration *candentibus ferramentis* (4.2.8); burning neck for tetanus *ferramentis aut sinapi* (4.6.5); burning hip for pain *candentibus ferramentis* (4.29.2–3); eliminating whitlow on finger *tenuibus ferramentis* after scraping with scalpel (6.19.3); opening abscess *candenti ferramento* (= knife? 7.2.4); burning bone *ferramento* in cases of fistula lachrymalis (7.7.7C); burning extruding eyelid *tenui ferramento* in correcting eversion/ectropion (7.7.10); burning blood vessels of temples *tenuibusque ferramentis et retussis* to relieve eyes troubled by thin rheum (7.7.15G); passing *tenui ferramentum candens* through clay tube or smooth reed for ozaena (7.11.1); burning gums with *candens ferramentum* for loose teeth (7.12.1); burning deeply split lip *tenui ferramento... spathae simile* (7.12.6); burning varix in scrotal skin *tenuibus et acutis ferramentis* (7.22.1); burning varicose veins in leg *tenui et retusso ferramento candente* (7.31.2); exfoliating diseased bone *ferramento* (8.2.2); inserting *candentia ferramenta* (= needle cauteries?) in holes made by trepan in diseased bone (8.2.4); relieving ulceration with *candens ferramentum* in connection with fractured rib (8.9.1G).

Considering the extensive use of the cautery it is not surprising that many different types were developed. Often only some general feature of a particular

type is described in the sources, so that we are left unsure precisely what shape it assumed. For example, when a cautery is described as στρογγύλος or περιφερής ('round or spherical') in the veterinary tracts,³⁶⁹ does this mean that it looked like the round flat model in the Colophon instrumentarium (Fig. 35), or like the disc on a ligula, or again like the olivary enlargement or *puren* on spatulas, etc. Vague descriptive terms of this type include straight (ὀρθός, *Hipp. Ber.* 2.23.5 & 13; *rectum*, *Mulomedicina Chironis* 364 & 549), flat or broad (πλατύς/*latus*, *Hippiatrica Paris.* 723.14; Caelius Aurelianus, *Chron. Diseases* 5.1.14), very flat (πλατύτερος, Aëtius 6.24.40), small (μικρός, Galen, *Comm. Hipp. Surgery* 18b.711K), long (μακρός/*lungus*, Paul 6.48.1; Caelius Aurelianus, *Chron. Diseases* 5.1.16), fine (λεπτός/*tenuis*, Paul 6.54.1; Celsus 7.7.10), small and fine (λεπτός καὶ μικρός, Paul 3.18.4), fine and oblong or longish (λεπτός καὶ ἐπιμήκης, Paul 6.42.1), fine and sharp (*tenuis et acutus*, Celsus 7.22.1), fine and blunt or dull (*tenuis et retusus*, Celsus 7.7.15G), pointed (*punctum*, *Mulomedicina Chironis* 86 and 88); thick (πάχος ἔχον, Oribasius, *Coll. Med.* 47.13.11), and plain (*simplex*, Caelius Aurelianus, *Chron. Diseases* 3.4.57).

Many types, however, are more clearly defined. These include:

Razors (ξυράφια)

In operating for cancers Pseudo-Galen says, "Some both cut and thoroughly cauterize them with fired razors" (*Intro. or Physician* 14.786K = Petit 19.10).³⁷⁰

Spatula or Cautery in the Form of a Spatula

As noted above Soranus tells us that some cauterize the severed umbilical cord of a newborn "with the flat of a probe", though he disapproves of the procedure (*Gyn.* 2.11.4 Ilberg = 2.6.25–29 BGM). The probe in question is surely an ordinary spatula probe.³⁷¹ On the other hand, when Celsus recommends that a split lip be cauterized "with a slender instrument which is like a spatula",³⁷² he most likely is referring to a small spatula-like cautery of iron (7.12.6). If he had a spatula probe in mind, one would have expected him to so indicate by *specillum*, his usual term for all types of probes. A further consideration is that the ordinary spatula probe would be rather large for the small area to be treated.

One can point to small spatulate cauteries in the Römisch-Germanisches Zentralmuseum, Mainz, and in the British Museum as perhaps representing

369 *Hippiat. Ber.* 26.16.9 (withers), 87.5.6 (mouse bite).

370 εἰσι δὲ οἱ ξυραφίοις πεπυρωμένοις ὁμοῦ τέμνουσι καὶ διακαίουσιν.

371 διὸ τινὲς μὲν μετὰ τὴν ἀποκοπὴν ἐπέκασαν τὸν ὀμφαλὸν διὰ αὐλοῦ θερμανθέντος ἢ διὰ τοῦ πλατέος τῆς μήλης.

372 *tenui ferramento adurere quod spathae simile.*

the instrument type that lies behind Celsus' words (Fig. 20, 7th from either side; Fig. 3, bottom row above stylus).³⁷³

Stylus

In treating of hip or sciatic conditions [Dioscorides] recommends, in addition to a host of other cauterizing procedures, raising the skin in the afflicted area and dividing it with a fired stylus (γράφίς) a distance of two fingers breadth (*Euporista* or *Simples* 1.235.2).³⁷⁴

Styluses occur in several instrumentaria.³⁷⁵ That in Fig. 3 (bottom row below cautery) is particularly suitable, being of iron.³⁷⁶

Cautery Applied through a Protective Tube

When cauterization was recommended for a condition existing in a confined space like the rectum or the nose, care had to be taken to protect the surrounding parts. The method adopted was to pass a slender cautery through a tube. As we have seen, the Hippocratics employ this procedure in treating hemorrhoids and nasal polyp.³⁷⁷ Later on Celsus (7.11.1) remarks that in treating ozaena, a fetid nasal polyp, some find a tube fashioned of clay (*ficilem fistulam*) useful as well as the reed tube (*scriptorium calamum*) favored in the Hippocratic treatise *Haemorrhoids* 6P, though he does not seem sold on the procedure. Finally, Antyllus and Heliodorus cauterize bone that is corrupted by a fistula along the palate of the mouth with a curved cautery having a flat terminus (βάσιν ἐπίπεδον) that can be passed through a curved tube of copper alloy (χαλκοῦς αὐλίσκος); see Oribasius (*Coll. Med.* 44.20.39–42 [Antyllus, Heliodorus]).³⁷⁸

373 For the Mainz specimen see Künzl (2002) 17(A12); for the one in the British Museum see Jackson (1986) 128(25) & 156.

374 —ἢ ἀποτείνας τὸ δέρμα κατὰ τὸν ἀलगούντα τόπον διαίρει γραφίδι πεπυρωμένη ἐκ διδακτυλίου διαστήματος.

375 Künzl (1983a) 45 Asia 1, 46(13.4) & 47(15.9 converted into retractor); 112 Moesia Inf. 4, 113(88.1); 116 Pannon. 2; 121 Raetia 5.

376 Jackson (1986) 128(26).

377 See also Galen's *Hippocratic Glossary* (19.111K); καυτήρα χάλκεον· καλαμίσκον τινὰ τετρημένον κατὰ τὸν πυθμένα, δι' οὗ καίειν ἐστὶ καυτηρίδιον διαφανὲς καθιέν.

378 Cf. the so called *Bamberger Surgery* 1095–1106, where a pastry tube “perforated like a clyster” is inserted into the nose as a guard in cauterization of nasal polyp: *factum ferrum et perforatum ad modum clistri in naribus aponatur . . . quod sit ex farina et aqua . . .* The text can be found in K. Sudhoff, *Beiträge für Geschichte der Chirurgie in Mittelalter*, 2 vols. (Leipzig 1914–18) 141.

In this category we may also include the application of molten lead through a fine funnel. This we find among treatments for aegilops, as excerpted by Galen from Archigenes (*Cmpds. by Place* 12.822K).

Tube as a Cautery

In the same passage as he disapproves of burning the severed umbilical cord of a newborn with the flat of a probe, Soranus adds that some cauterize with a heated tube (διὰ αὐλοῦ θερμανθέντος). He likewise disapproves of this method (*Gyn.* 2.11.4 Ilberg = 2.6.25–29 BGM).

Triangular Cautery

To cure surgically the condition called ῥυάδες ὀφθαλμῶν or ‘weepy/rheumy eyes’ Aëtius severs the vessel around the nose and then burns the wound with a three cornered cautery (7.90.13–14 = Hirschberg, Waugh pp. 128–129. Chp. 90, ἔστω δὲ τὸ καυτήριον τρίγωνον). This triangular type is reminiscent of the cauteries shaped like wedges prescribed by Hippocrates for diseases of the head (*Diseases* 2.12P).

Needle

To kill eyelashes irritating the eye, Celsus passes over their roots a fired slender iron needle resembling the head of a spear/lance at its theraputic terminus (7.7.8B).³⁷⁹ He probably has in mind the instrument mounting an iron/steel needle on a slender shaft of copper alloy as shown and discussed above (see under Needles, Needles for Cataract Surgery and Other Eye Conditions; Fig. 3, 10th from rt.). This type was abundant at Pompeii and, therefore, roughly contemporary.

Celsus also mentions cosmetic correction of abnormally large piercings of the earlobes with a fired needle (7.8.3: *candenti acu*). Here he may envisage the instrument just described or only an ordinary household needle.

Lunated Cautery

Only Oribasius (*Coll. Med.* 50.7.4) and Paul (6.57.1) mention a ‘moonshaped cautery’ (καυτήρ μάλιστα μηνοειδής or μηνοειδὲς καυτήριον). In circumcision of gangrenous foreskin both authors recommend use of this type to staunch bleeding and to prevent further spread of the disease. An iron remnant in the instrumentarium of the Bingen surgeon has been proposed as the cautery in question (Fig. 36).³⁸⁰ It consists of a small crescent offset from the shaft.

379 *tenuis acus ferrea ad similitudinem hastae lata in ignem coicienda est—.*

380 See Bliquez (1981) and (1984); in agreement are Künzl (1983a) 25 and Jackson (1991) 8.

The Bingen instrumentarium has been dated to the first or second century; accordingly we can push the existence of the lunated cautery back to that time. Oribasius probably depends for his information on Antyllus or Heliodorus; so the lunated cautery will have been mentioned in surgical manuals composed during or even prior to the career of the Bingen surgeon.

Trident Shaped Cautery

We have seen in the *Hippocratic Corpus* that surgeons treated dropsy by cauterization.³⁸¹ This method of treatment was still in vogue in Paul's time. He tells us to stretch the skin above the spleen with a sharp hook and, with a long incandescent cautery, to burn right through the raised portion three times, so as to form six eschars or scabs (6.48.1). Paul adds that Marcellus³⁸² performed the operation with a *triaine* or trident shaped cautery (τριαίνῃ ἢ τριαινοειδεῖ καυτηρίῳ), so that all six scabs were formed at once. Caelius Aurelianus also says that in treatment of the spleen, "some recommend application of plain . . . some three-pronged cauteries" (*Chron. Diseases* 3.4.57: *quidam simplices* (sc. *cauterēs*), *quidam trisulcos* . . . *approbant figendos*). By 'some' Caelius may only mean Marcellus.

Typical of 'virtuoso' instruments created by named inventor-surgeons, the trident cautery never seems to have caught on, probably because a simple elongated cautery did the job just as well, if not better. That would explain why the trident cautery is so little mentioned in the literature.³⁸³

Serrated Cautery

Caelius Aurelianus criticizes physicians who approve of burning with a serrated cautery (*ex cauteriis serratis*)³⁸⁴ the small veins of the head in treating

381 *Internal Affections* 25P.

382 Surely Marcellus of Side, active under the Antonines; see Arnaud Zucker's entry in Keyser and Irby-Massie (2008) 530; also Kroll *RE* XIV 2, 1496–1498 who cites Pseudo-Galen, *Drugs Easily Procured* 14.459K re Marcellus' interest in splenic diseases.

383 What is surely just a fork (although with long tines) was found in a surgeon's grave at Paris; see Künzl (1983a) 25, 77(51.28). Also, Vulpes saw in a three-pronged item of copper alloy in the surgical collection of the Naples Museum a specimen of the *triaine*. My own investigation reveals that this piece has nothing to do with Pompeii or Herculaneum, having come into the Museum via the Borgia collection (Bliquez, Jackson (1994) 45). It therefore has no medical provenience and is surely only a hairpin or a small fork. In addition to instruments, other objects are sometimes found in the tombs of surgeons; see Bliquez (1982) 203.

384 There is an alternate reading in ms. S: *ferratis*. *Serratis* is preferred by way of comparison with *Chron. Diseases* 3.4.57.

cephalaea = chronic headache (*Chron. Diseases* 1.1.46). Likewise, he does not follow those who cauterize with the same instrument the area over the liver and spleen in dealing with diseases afflicting those organs (*Chron. Diseases* 3.4.57: *quidam simplices (sc. cauterēs) . . . quidam serratos approbant figendos*).

Cauteries Shaped like Knives, Nails, Bricks, Lentils and the Letter Gamma

For dealing with hernias Paul states that ‘The Moderns’ prefer cauteries as opposed to treatment with the knife. These assume a variety of shapes. In the operation for hydrocele ten to twelve gamma shaped types (γαμμοειδεῖς) are needed and two knife-shaped models (μαχαίρωτοι). Most of the former are used to burn into the middle of the scrotum, followed by one of the latter to expose the tunica vaginalis. This is opened with the terminus (τῷ ἄκρῳ) of the last gamma shaped cautery, allowing evacuation of the fluid. Finally, the membranes containing the fluid are removed with the second knife shaped model (6.62.4). Caelius Aurelianus also deploys gamma shaped cauteries in the treatment of sciatica (*cauterēs semper adunctos in modum gamma literae: Chron. Diseases* 5.1.19).³⁸⁵

No recognizable gamma cautery survives but instruments like this may simply have been constructed on the spot of fine little iron rods bent into the proper shape. If so, they will not have endured for long, even in their own time. Some sharp hooks of copper alloy (see below) may also have been serviceable in this regard; but the quantity needed for the hydrocele operation as described by Paul makes the first alternative more likely.

The ‘knife’ type was probably no more than the heated steel blade of a simple scalpel. When Celsus opens a deep-seated abscesses *candenti ferramento* he probably is using a knife deployed as a cautery (7.2.4). We find a parallel in Pseudo-Galen where it is said that some excise tumors with fired razors (see above).

In cases of bubonocoele or inguinal hernia, Paul tells us that ‘The Moderns’ again eschew the knife and prefer burning (6.66.2). The procedure here is first to define the swollen area with a triangle in black ink and to make a black mark in the middle of the triangle. To this mark cauteries shaped as nails (ῥλωτούς)

³⁸⁵ One is tempted to include in the gamma category the cautery called ἀγκῆρ in John Zonaras’ account of the treatment administered to Alexius I Comnenus (1081–1118) just before his death. That instrument is said to be bent at its end (διὰ τὸ κεκάμφθαι πρὸς τὸ ἄκρον αὐτὸ). It was applied to the stomach, a curious application because the symptoms of the patient were sore feet. See Joannes Zonaras, *Historical Epitome* ed. Büttner-Wobst (*lib.* 13–18) p. 759.6–28.

are applied; next gamma cauteries burn the sides of the triangle; then cauteries shaped like bricks or like lentils (τοῖς πλινθωτοῖς ἢ φακωτοῖς) are laid on the entire surface of the triangle so as to make it level. Paul says ten cauteries in all are employed but he gives no specific numbers for each of the types.

Again we are probably dealing with improvisation or the use of other instruments as cauteries. For example, iron nails would make perfectly good cauteries, and a ligula with its tiny round bowl or a rectangular stylus might be referred to respectively as 'lentil-like' or 'brick-like' if used for cauterization. In any case readily recognizable cauteries of these types cannot be found among surviving instruments. By way of contrast, in a few cases we have recovered what could be cauteries to which we cannot securely match names.³⁸⁶

Olivary Cauteries

In later authors we find recourse to the πυρηνοειδὲς καυτήριον (rarely πυρηνοειδὲς καυτήρ) or olivary cautery. Often, several are used in the same procedure. The text of Paul is particularly replete with references in a wide variety of operations. These include application to the top of the head to relieve ophthalmia (6.2.1), burning malignant nasal polyp (6.25.2), burning gangrene consequent on epulis and parulis (6.27.1), and cauterizing bone diseased by a fistula formed between the canthus and nose in cases of aegilops (6.22.1). Paul also utilizes the same instrument to open abscess of the liver (6.47.1) and says 'The Moderns' create with olivary cauteries three escars over a stomach disturbed by 'chronic defluxions' (6.49.1). Although he knows through Leonides of opening empyema with the πυρηνοειδὲς καυτήριον, Paul disapproves of this approach (6.44.2). Like Aëtius, he attacks severe headache by applying the instrument to the temporal vessels (6.5.1), though Aëtius warns of applying the olive to the major muscles in the area (6.50.20 [Galen and Archigenes]; 7.93.28 [Leonides]). Olivary cauteries likely also lie behind Cornarius' Latin rendering of Aëtius 14.8 where Leonides is recorded as burning *per cauteria nucleiformia* the exterior of the anus to arrest prolapse. Finally, Oribasius applies fired olivary cauteries to eliminate the varices in cirsocele/varicocele (*Coll. Med.* 45.19.1 [Heliodorus]).

As far as the appearance of the instrument is concerned, the *puren* or olivary end of the spatula probe, the spoon probe ('cyathiscomele'), or the *dipyrene* comes immediately to mind, and there can be little doubt that the *puren*

³⁸⁶ For example the two pointed iron spits in the Luzzi instrumentarium: Künzl (1983a) 106(85.13–14). These, however, if cauteries, fit with the type called pointed (*punctis cauteriis*) in *Mulomedicina Chironis* 86 & 88. The type was used to treat a tumor caused by a blow to the eye, and struma and parotis.

on these instruments is what is meant by πυρηνοειδές καυτήριον. In fact many texts refer explicitly to cauterization with the olivary end of a probe, especially where delicate interventions are at issue, as around the eyes for growths such as kritte and posthia.³⁸⁷ Different sizes and shapes of the πυρήν were desired: e.g., Paul wants them “fine” (λεπτὰ) for liver abscess 6.47.1. For variations see s.v. under Probes.

Cautery for Aigilops (Fistula Lachrymalis)

There are a number of references in the literary sources to a fistulous abscess between the large canthus and the nose, called in Greek ‘goat’s eye’ or aigilops. According to Paul, the condition was treated by dissecting out the diseased channel if the abscess had burst; if it had not, it had to be laid open to the bone. The bone had to be scraped if healthy but cauterized if decayed (6.22.1). Paul calls the cautery to be applied the ‘aigilops cautery’ (αἰγίλωπικόν καυτήριον). Centuries later Leon Iatrosophistes refers to a ‘fistula cautery’ (συρριγγιακός καυτήρ) in his abbreviated account of the same condition (*Consp. Med.* 3.22.4). Since Paul includes olivary cauteries (πυρηνοειδέσι καυτηρίοις) in close proximity with the aigilops cautery for this condition (lines 7 and 11), the latter was probably just a version of the former. If so, a particularly attractive candidate is the *puren* equipped needle (presumably) handle excavated at Rheims in the instrumentarium of the ophthalmologist G. Firmius Severus (Fig. 32).³⁸⁸

Natural Substances Used in Cauterization

The physician Herodotus notes that roots or drugs might be employed as alternatives to burning with metal cauteries, though he prefers the latter (Oribasius, *Coll. Med.* 10.11.1). The Hippocratics used heated olive oil applied on boxwood rods or sponges and ignited fungi.³⁸⁹ Later authors continued the practice. [Dioscorides], among others, mentions the use of olive oil and wool soaked with it (ἔριον ἐλαίῳ βρέξας, *Euporista or Simples* 1.235.3), while Paul attests cauterization with *iskai* (ἴσκαι or ἴσχαί) over the stomach for ‘chronic defluxions’ and dropsy (6.49.1 & 6.50.3), and Aëtius places them over the temples for ‘chronic defluxions’ around the eyes (7.91.4). *Iskai* are said by Aëtius to be the pith of the walnut tree (τῇ ἐντεριώνῃ τῶν καρπύων ξύλων), while Paul includes spongy growths on oak and walnut trees (εἰσὶ δὲ σπογγώδη τινὰ σώματα αἱ ἴσκαι ἐν ταῖς δρυσὶ καὶ ταῖς καρύαις γινόμεναι). If Paul is correct, these substances may be the same as the ignited fungi in Hippocrates and the *lignei fungi* we find

387 Aëtius 7.84.1–4 = Hirschberg, Waugh pp. 120–121. Chp. 84: θεραπεύεται δὲ ῥαδίως πυρήνι μῆλης τεθερμασμένῳ πυριωμένη (sc. κριθή).

388 For the entire instrumentarium see Künzl (1983a) 65(36.31).

389 *Int. Affect.* 28P; *Sight* 3P.

in Caelius Aurelianus' passages on sciatica (*Chron. Diseases* 5.1.20). Both Paul and Aëtius agree that the *iskai* treatment is one employed mostly by barbarian peoples. Alexander of Tralles too knows of *iskai* and their barbarian associations (*Therap.* 2.535.27).

Aëtius and Paul also mention as a burning agent ἀριστολόχεια (birthwort): the former (along with στρούθιον or soapwort) for sciatica (12.1.209), and the latter to treat empyema (6.44.1). Other fired materials recommended for sciatica by [Dioscorides] include goat's dung,³⁹⁰ olive oil, clay, or, following Libyan methods, a 'pyramid' compounded of lotus, native sulphur, and squirting cucumber (*Euporista or Simples* 1.235.1–2).

Retractors and Hooks

Although the *Hippocratic Corpus* does not mention the hooked retractor, it is frequently cited in Celsus and subsequent authors and eventually makes its way onto *Lists*.³⁹¹ It is clear, therefore, that along with the scalpel, the cupping vessel, the cautery and the probe, the hooked retractor was a basic instrument of surgery from the Hellenistic age into Byzantine times. No surprise then that at least one specimen is found in surviving instrumentaria of any consequence.³⁹²

Sharp Hook

More frequently referred to in the literature, and the model commonly found in instrumentaria, is a slender sharp variety, to which the name ἄγκιστρον/*ankistron* was given in Greek and *hamus* or *hamulus* in Latin.³⁹³ To emphasize the sharpness of the instrument a modifier is occasionally found: thus, ἄγκιστρον ἔπακμον (Oribasius, *Coll. Med.* 45.18.13), and *hamulus acutus* (Celsus 7.7.4B). In the latter passage Celsus calls the point of the instrument *mucro*, the same term he uses for the point of a scalpel blade.

In a veterinary source the instrument is called ἄγκιστρον ἱατρικόν, doubtless to distinguish it from a fish-hook, which also goes by the name ἄγκιστρον (*Hippiatrica Ber.* 11.39.9). Rarely the term ἄγκιστρον designates the τυφλόγκιστρον, or blunt type (Oribasius, *Coll. Med.* 45.18.8; 50.48.6), or the varix hook (κίρσουλαός, Oribasius, *Coll. Med.* 45.18.5). For both, see below.

390 See also Aëtius 12.1.215–222.

391 Schoene (1903) 281; Bliquez (1984) 198; Fischer (1987) 35(16).

392 For examples see Künzl (1983a): 47(6–9), 65(18–22), 83(15–18), 90(5), 94(11, 12), 104(7), 106(6), 111(4), 120(2); Bliquez, Jackson (1994) 124–128(61, 74, 81) & 209 (A34).

393 Marganne (1994) 105 cites an instance of the diminutive ἀγκίστριον in a surgical papyrus.

The sharp hook was particularly handy for piercing and raising tissue prior to lancing, excision or repair. Paul, for example, in positioning a horse's hair to raise for excision a pterygium, a wing-like growth extending from the inner canthus of the eye, says:

When we have separated the eyelids, we engage the pterygium with a sharp retractor, slightly bent, and put it on the stretch... (6.18.1).³⁹⁴

The same author in performing tonsillectomy first seats the patient in good light and has one assistant hold his head steady while a second assistant depresses his tongue. Then:

We take a sharp retractor and pierce the tonsil and draw it outwards as much as possible without drawing its membranes along with it. Next we excise the tonsil from its base with the tonsillotome (see s.v. under Other Cutting/Puncturing Instruments) appropriate to that hand (6.30.2).³⁹⁵

An extended list of interventions of this sort, arranged by author, includes:

Aëtius of Amida: engaging and raising growths on the white of the eye (7.59.4 = Hirschberg, Waugh pp. 92–93. Chp. 59); gently raising pterygium and raising the upper eyelid if necessary (7.62.2–20 = Hirschberg, Waugh pp. 96–97. Chp. 62); raising eyelids adhearing along the canthus (7.66.6 = Hirschberg, Waugh pp. 98–99. Chp. 66); positioning redundant skin of eyelid for dissection in plastic operation thereon (7.71.38–41 [Leonides]) = Hirschberg, Waugh pp. 106–107. Chp. 71); raising the fleshy mass for insertion of needle in correcting ectropion (7.74.18 [Antyllus] = Hirschberg, Waugh pp. 110–111. Chp. 74); raising the frenulum to correct ankylosis (8.38.14–16); raising tonsils for excision (8.51.26); raising and twisting hemorrhoids before excision to avoid excessive bleeding (14.5, Cornarius); raising growths interfering with childbirth for excision (16.23.16–20 [Philumenus]); raising for dissection and excision growths blocking the female parts (16.108.25–39); suspending hemorrhoid of the womb for binding and excision (16.109.11); raising for division tissue containing fluid in operating for hydrocele in the womb (16.112.10 [Aspasia]).

Celsus: to raise pterygium (7.7.4B); to raise encanthis (7.7.5); to raise tonsils for excision (7.12.2); raising hemorrhoids for excision (7.30.3B).

394 διαστειλαντες τὰ βλέφαρα τὸ πτερύγιον ἀγκιστρῷ μικροκαμπεῖ ἀναδεξάμενοι ἀνατείνωμεν...

395 λαβόντες ἄγκιστρον καταπείρομεν εἰς τὴν ἀντιάδα καὶ ἐξέλκομεν αὐτήν, ἐφ' ὅσον δυνάμεθα χωρὶς τοῦ συνεφελκύσαι τοὺς ὑμένας· ἔπειτα τέμνωμεν αὐτὴν ὅλην ἐκ βάσεως τῷ κατὰ χεῖρα ἀγκυλοτόμῳ...

Mulomedicina Chironis: to hold a pulmunculus for dissection (667).

Oribasius of Pergamon: raising and exposing abscesses (*Coll. Med.* 44.5.24 [Antyllus and Heliodorus]; *Ecl. Med.* 97.36); raising and exposing rectal abscess (*Coll. Med.* 44.11.3); stretching anal fistula for excision (*Coll. Med.* 44.20.65 [Antyllus and Heliodorus]); stretching steatoma for excision (*Coll. Med.* 45.2.6 [Antyllus]); positioning ganglion on head for excision (*Coll. Med.* 45.10.2 [Antyllus]); exposing boney growths for excision (*Coll. Med.* 46.29.5 [Heliodorus]).

Paul of Aegina: raising redundant skin of the eyelid for dissection in plastic operation thereon, or simply raising fold of eyelid (6.8.1 & 3); stretching margin of upper eyelid to free adhesion (6.15.1); raising pterygium (6.18.1); raising epulis for excision (6.27.1); raising the frenulum to correct ankyloglossia (6.29.1); raising tonsils for excision (6.30.2); stretching skin before incising for laringotomy (6.33.1 [Antyllus]); raising a ganglion of the head for dissection (6.39.1); raising overlying skin in cauterization of armpit and spleen (6.42.1 and 6.48.1); raising the hernia prior to binding in correcting exomphalos (6.51.2); transfixing and stretching tissue for incision in opening blockage of the female parts (6.72.1).

Sharp hooks could also be used as hemostats when they were inserted in blood vessels and twisted around; e.g., Oribasius, *Coll. Med.* 50.47.4 (operating in the groin) and Soranus, who asserts that uterine hemorrhages cannot be stopped using sharp hooks in this way (*Gyn.* 3.40.2 Ilberg).³⁹⁶

The following sources demonstrate that the sharp hook was used to retract the lips of surgical incisions to clear the way for deeper work with the scalpel or other instruments.

Aëtius of Amida: exposing veins in angiology (7.95); retracting edges of incision to expose strumae/scrofula (15.5.62–66 [Leonides]); exposing aneurysm (15.10.41).

Celsus: exposing abscess under tongue (7.12.5); retraction of the middle tunic in treatment of inguinal hernia (7.20.4–6); exposing varicose veins (7.31.2).

396 BGM 3.12.10 emend Ilberg's text (based on ms. P) to read ἀγτήρων instead of ἀγκίστρων, arguing that a sharp hook would be unsuitable for work inside the womb as opposed to an *ankter*, which they regard as a pin. But unsuitability is precisely the point Soranus is making. In any case an *ankter* is a knotted piece of cloth or a stitch, not a pin. For my view of *ankter* see Appendix, Materials, Sutures, Plugs, 'Tents', etc., s.v.

Oribasius of Pergamon: exposing steatoma (*Coll. Med.* 45.2.4 [Antyllus]); exposing poros (*Coll. Med.* 45.6.2); exposing scleroma (*Coll. Med.* 45.7.3); exposing strumae/scrofula (*Coll. Med.* 45.17.9); exposing varicose veins (*Coll. Med.* 45.18.13); exposing aneurysm (*Coll. Med.* 45.24.4 [Antyllus]); retracting tissues overlying a rib prior to excision of the latter (*Coll. Med.* 44.8.1); stretching and opening the foreskin in operating for phimosis (*Coll. Med.* 50.5.4 [Antyllus]); operating in the groin (*Coll. Med.* 50.46.1–4).

Paul of Aegina: exposing veins in angiology (6.5.1); retracting edges of incision to expose strumae/scrofula (6.35.2); exposing an aneurysm (6.37.2); retracting and opening the prepuce in correcting phimosis (6.55.1); exposing the tunica vaginalis in correcting hydrocele (6.62.2); exposing vessels in treating cirsocele (6.64.2); exposing enterocele (6.65.2); exposing varicose veins (6.82.1).

Frequently, several hooks—as many as three or four—were applied at the same time (Oribasius, *Coll. Med.*, 45.18.13, 50.46.1–4; Paul 6.55.1). Rarely the sharp hook was used to widen a previously existing opening, as the mouth of a fistula (Celsus, 7.7.7C; aegilops). It was also employed in extracting scales of exfoliating bone (Paul, 6.107.3), removing objects from the auditory canal (Paul, 6.24.1), and isolating and positioning a varix for extraction (Oribasius, *Coll. Med.* 45.18.18ff.).³⁹⁷ Naturally, it is one of Galen's favorite instruments for dissection.³⁹⁸

Sometimes, as among the Hippocratics, a forceps (Pseudo-Dioscorides, *Venomous Creatures* [Theriaca] 2.32, bite of rabid animal; Philumenus, *Venomous Creatures* 2.6.8, rabid dog; Oribasius, *Coll. Med.* 45.10.2, treating ganglion) or even fingers could be substituted for the sharp hook (Paul 6.8.3).

As indicated above, many specimens survive (Fig. 2, bottom row, 1st from left; Fig. 3, middle row 4th–6th from rt.; Fig. 20, first four from left). The hook is generally mounted on a nicely turned shaft that terminates in a finial resembling a baluster, a doorknob or a raised button (Fig. 37). In rare cases two hooks appear at one terminus (Fig. 39).³⁹⁹ An extremely handsome specimen in the Römisch-Germanisches Zentralmuseum, Mainz sports the knotty club and

397 Here *ankistron* might just as well refer to a blind hook, for which see immediately below.

398 Eighteen occurrences in *Anatomical Procedures*. In raising an intercostal nerve Galen requires a special type that is short (μικρὸν μὲν τὸ μήκει...), neither too sharp nor blunt and tapered at its terminus (χρὴ τοῖνον δὲ μὲν οὐδαμῶς ὑπάρχειν αὐτὸ, καθάπερ οὐδ' ἐσχάτως ἀμβλύ, λελεπτύνθαι δ' εἰς τοσοῦτον κατὰ τὸ πέραις): *Anat. Proc.* 2.667K = 11.501Gar.

399 For another bifurcated specimen, see Jackson (1995) 205. If *diplancistron* (as intended for raising a blood vessel), is actually what the author of *Mulomedicina Chironis* 100 wrote, he may have envisaged a double hook of this type.

lion's head of Hercules (Fig. 20, far left); another from Aschersleben terminates in the snake of Asclepius (Fig. 38, far left).⁴⁰⁰ Handles and shafts may be decorated with a diamond or broad lattice pattern, a fine lattice pattern, and striation. These motifs may occur singly or in combination. On occasion we find silver inlay, or the tip of the hook, or even the whole instrument in silver.⁴⁰¹ The hook is always sharp and slender but it can be longer or shorter, rounder or straighter, and offset at various angles. These distinctions are reflected in the modifying adjectives applied in the literature: 'small' (μικρόν, Galen, *Anat. Proc.* 2.681K = 11.519Gar), fine (λεπτόν, Galen, *Cmpds. by Place* 12.659 [Apollonius]), sharply bent (ὀξύκαμπές: Oribasius, *Coll. Med.* 45.18.13), slightly bent (μικροκαμπές: Oribasius, *Coll. Med.* 45.18.5), with the point slightly bent inward (*paulum microne intus recurvato*: Celsus 7.7.4B), and sturdy (εὐτόνον: Oribasius, *Coll. Med.* 45.7.3). There is one testimonium to an ἄγκιστρον διάτρητον, or an eyed hook. Galen allows for its use or that of a curved needle to position thread under an intercostal nerve in *Anatomical Procedures* 2.668K = 11.503Gar.

There are, in addition, sharp hooks mounting another instrument at the opposite terminus. Three and possibly four (Fig. 42 = Fig. 84, 4th from rt.) feature, in addition, a steel or iron needle for probing and fine dissecting (likely for eyework), while another in Naples mounts a small ligula.⁴⁰² In the remarkable set from Asia Minor in the Römisch-Germanisches Zentralmuseum, Mainz, we find two sharp hooks mounted on a single shaft and one sharp hook created by bending the writing tip of a stylus (Fig. 20, 2nd–4th from left), while in instrumentaria preserved in Rheims and Nijmegen a sharp hook is opposed to a blunt two-pronged retractor (Fig. 89, ensemble at lower rt.).⁴⁰³ It is to the latter category that we now turn.

Blunt or Blind Hook

In later Greek authors we find mention of a *tuphlankistron* (τυφλάγκιστρον) or blind/blunt hook. Oribasius is quite explicit as to its differentiation from the sharp type (*Coll. Med.* 45.18.8):

Let it (the hooked part) be non-pointed, *tuphlankistron* as the surgeons call it.⁴⁰⁴

400 Künzl (1983a) 47(15.6), 101(80.1). The handle of Fig. 37 probably features the club of Hercules.

401 Künzl (1983a) 90(68.5), 106(85.6), 111(87.4) and Fasold (1998) 36; Jackson (1986) 140.

402 Of models with needles, one is reported from Cyzicus (Heres 1992 159–164) = Fig. 83, one at Rimini: Jackson (2003) 317, and one and possibly two are in Naples (Bliquez, Jackson 1994 128(81) and 166(230); for the ligula, see Bliquez, Jackson (1994) 128(80).

403 Künzl (1983a) 47(15.7–9), 65(35.19) and 94(75.12).

404 τὸ ἄγκιστρον (ἔστω δὲ κατὰ τοῦτο μὴ ἑπακμον, ἀλλ' ὡς οἱ χειρουργοὶ καλοῦσι, τυφλάγκιστρον).

In the same chapter of *Coll. Med.*, Oribasius also calls this hook τὸ τυφλόν (sc. ἄγκιστρον) and its apex ἡ κορυφή (8–11). When the context is clear, he may simply call it ἄγκιστρον, the name for the sharp model (*Coll. Med.* 50.48.6).

The blunt hook served mainly for retraction, dissection, and elevation. For example, Aëtius finds it appropriate for stretching for dissection eyelids adhering to the eyeball (7.66.8 = Hirschberg, Waugh pp. 100–101. Chp. 66) and Paul for exposing hydrocele and enterocoele (6.62.4 and 6.65.2). Likewise Oribasius applies the instrument in raising superfluous peritoneum for excision (*Coll. Med.* 50.48.6) and in prying out fragments of fractured skull (*Coll. Med.* 46.15.5), or the stony growth called poros/tophus (*Coll. Med.* 45.6.6). All three authorities elevate and sometimes twist blood vessels with the *tuphlankistrōn*; varices for example, (Oribasius, *Coll. Med.* 45.18.8; Aëtius 14.84 (Cornarius, *vas . . . caeco uncino attrahitur*) and 16.114.7; Paul 6.82.1), or the temporal vessels in angiotomy (Paul 6.5.1; Aëtius 7.95.12), or an aneurysm (Aëtius 15.10.33). Finally, Oribasius uses it as a block for the scalpel in severing a varix (Oribasius, *Coll. Med.* 45.18.25) and to thrust away an interfering vein in accessing an aneurysm (*Coll. Med.* 45.24.4 [Antyllus]).

Celsus several times refers to a *hamulus retusus*. This is surely the same as the *tuphlankistrōn* because he too brings it to bear in elevating varicose veins (7.31.3). Celsus also says that we can extract foreign objects from the ear with an ear probe or a blunt hook (*specillo oriculario—aut hamulo retuso*, 6.7.9).

Information on the shape of the instrument comes from Celsus and Oribasius. The former prefers for clearing the auditory canal a blunt hook that is *paulum recurvato*, which Spencer renders as ‘slightly bent’ (6.7.9). In contrast, Oribasius once recommends *tuphlankistra* that are μεγαλοκάμψη or “sharply bent or offset” (*Coll. Med.* 45.6.6).⁴⁰⁵ In addition, Oribasius once refers to the δορίδιον τυφλαγκίστρου as being useful for prying up an impacted finger ring before cutting it away with a saw or file (*Coll. Med.* 47.17.5). *LSJ* interprets δορίδιον in this passage as “shaft or hook of a probe.” However, Oribasius simultaneously recommends a πλατὺ μήλης, or the spatula of a probe, for the same purpose. This hints that something broader than a ‘shaft’ is wanted. Δόρυ also means ‘beam’ or ‘plank’ and that is likely the sense of its diminutive δορίδιον here. The reference would then be strictly to the broad therapeutic plate of the *tuphlankistrōn*, as opposed to its shaft. Thus, Oribasius intends that the operator should place the plate of this type of hook under the ring, both to raise it and at the same time to use it as a block to support the ring and protect the finger while a saw or file is being applied.

Something like a dozen examples of instruments we can consider as blunt hooks survive. All feature a broad plate, sometimes curved, sometimes sharply

405 Not “with a large curve,” as *LSJ* would have it; see below.

offset, at one or both ends. They come from all over the Roman world and can be divided into a number of types. The most common consists of a shaft from which, at one or both terminals, a kite or flat leaf-shaped plate extends vertically (or nearly so) from the shaft (Fig. 3, middle row, 3rd from rt.; Fig. 49.17); in some cases a sharp hook is mounted at the opposite end.⁴⁰⁶ The presence of corresponding sharp hooks supports the identification of the plates on these pieces as representing the *tuphlankistron*, as does Oribasius' linking of blunt hooks with the *πλατὺ μήλῃς*. If we have correctly classified this type as a blunt hook, it must be the model Oribasius has in mind at *Coll. Med.* 45.6.6. A second type may be seen in an instrumentarium from Asia Minor preserved in Mainz (Fig. 20, 3rd from rt.). It features a roughened lithotomy hook opposite a blunt two-pronged retractor, indicating that the latter type could also be used in lithotomy (see *lithoulkos* below).⁴⁰⁷ A quite similar specimen from Nijmegen (Fig. 89, ensemble lower rt.) mounts a sharp hook at one end and a sharply offset two-pronged retractor at the other,⁴⁰⁸ while a third example from Italy mounts a *puren* at one terminus.⁴⁰⁹

Finally, there are oddments, such as the snake motif conjectured as useful for retraction on several instrument types, e.g., the sharp hook shown on Fig. 38, far left.⁴¹⁰ To these we may add approximately half a dozen small curved models, perhaps eyelid retractors,⁴¹¹ and the same number of models shaped rather like a nutpick (Fig. 40).⁴¹² This might represent the type Celsus describes as *paulum recurvato*. As it is semi-sharp, it would be appropriate for excision of a portion of the peritoneum as described in Oribasius (*Coll. Med.* 50.48.6).

406 See Jackson's list (1986) 142. Jackson reports three more in the fabulous find at Rimini (2003) 314, one of which he figures in the ensemble shown on 316, Fig. 2; see now also Jackson (2009b) 84, 88. For examples of a blunt hook opposite a sharp one see Künzl (1983a) 65(35.19) and (2002b) 31 (B26). Jackson (1990a) 15.6 and now Kirova (2002) 76.

407 Künzl (1983b) Taf. 60.3.

408 Künzl (1983a) 94(74&75.12).

409 Künzl (1983b) Taf. 64.3; Jackson (1990a) 15.5.

410 So also the *coudée* forceps from Littleborough on Trent published by Jackson, Leahy (1990b) 272–273.

411 Jackson (1990a) 15.9; Bliquez, Jackson (1994) 214(A53–5); Künzl (2002b) 31 (B25). At *Mulomedicina Chironis* 73, if Oder is correct in reading *tyflogdiplangistris* for *tyflogiplangistris*, the author may envisage some kind of double blunt model for retraction of the eyelid.

412 See Caton (1914) 115, Pl. x.19 for Colophon; Jackson (1990a) 15.8 for Springhead Kent (medical provenience certain?); Künzl (1983a) 47(7 & 8) and (2002b) 17(A7 & A8). What looks to be another candidate can be found in a set in the Piraeus Museum. It features a handle at one terminus, similar to those on one of the *cannulae* and the quadri-valve *speculum* at Naples shown in Bliquez, Jackson (1994) 169(236), 183(291). It also has a curious clip at one side of its shaft. See Steinhauer (2001) 265.

There the process involves inserting two blunt hooks into the peritoneum (καταπείραντες εἰς τὰ χεῖλη τοῦ περιτοναίου δύο τυφλάγκιστρα) and positioning it by twisting before amputation.

Another name for the τυφλάγκιστρον may be *parastoleus*/παραστολεύς. *Lists* alone⁴¹³ attest the term, but in the literature the verb παραστέλλω occurs several times in the sense of ‘retract’ (Galen, *Anat. Proc.* 2.523K = 11.327Gar; Oribasius, *Coll. Med.* 45.6.6).

Varix Extractor

Although we hear for the first time of an operation for varicose veins performed on Gaius Marius,⁴¹⁴ a special instrument for accessing and positioning the varix, the so-called κίρσουλκός/*kirsoulkos*, is only mentioned much later, and then in only two sources: Pseudo-Galen, *Intro. or Physician* 14.790K = Petit 19.15, and Oribasius, *Coll. Med.* 45.18.5 and 26. The former succinctly describes its use as follows:

As to varicose veins in the legs, we first mark them out with incisions/scarifications all along the surface. After we lay (the patient) down we pull up the [scarified] skin from the surface and first divide it. Next we raise the vein with a sharp hook (*ankistron*), tie it off after we have made all the incisions, cut the ends and extract it with a *kirsoulkos*, or we pull it out with a *dipyrene* by twisting it up/back, having bound it through the middle with linen thread.⁴¹⁵

For details as to the appearance of the instrument we depend completely on Oribasius’ account. When the varices have been marked out with incisions and the patient has been properly positioned, he says:

(5)—next we take hooks of the type very slightly curved, called *kirsoulkoi*, shaped like the letter gamma at the bend. When we have pierced the skin on top along the most conspicuous part of the varix that is marked off by

413 Schoene (1903) 283; Bliquez (1984) 201; Fischer (1987) 35(15).

414 Cicero, *Tusculan Disputations* 2.15.35; Pliny, *Nat. Hist.* 11.252; Plutarch, *Marius* 6.3.

415 τοὺς δὲ ἐν τοῖς σκέλεσι κίρσους πρῶτον ἔξωθεν ἐπισημηνάμενοι δι’ ὅλου ἐγχαραῖσιν, εἴτα κλίναντες, ἐξ ἐπιπολῆς λαβόμενοι τοῦ δέρματος, αὐτὸ πρῶτον διαιρούμεν, εἴτα ἀγκίστρῳ ἐπισπώμενοι τὸν κίρσον διαδέομεν καὶ μετὰ πάσας τὰς διαιρέσεις τοῦτο ποιήσαντες, ἢ κίρσουλκῳ ἐξαιρούμεν διακόπτοντες τὰ ἄκρα ἢ διπυρήνῳ διαλαβόντες λίνῳ διὰ τῆς κοιλίας τοῦ κίρσου κατ’ ἀναστροφὴν ἐξέλκομεν.

incision and, when we have retracted the skin to the side along the leg and wound the skin on the bend,—we make a shallow incision—.”⁴¹⁶

As Pseudo-Galen, Oribasius goes on to say (26) that one of the ways of raising the varix for excision is “through the construction of the *kirsoulkos*” (... ἢ καὶ διὰ τῆς τοῦ κίρσουλκου κατασκευῆς ἐπισπασάμενοι τὸν κίρσόν...).

The account of Oribasius is crucial because it clearly shows that the *kirsoulkos* was not a forceps, as had been thought,⁴¹⁷ but if gamma shaped, a type of hook offset from its handle. As its function was to clear the way to the varix by retracting and winding the skin and, as it was capable of piercing, it had to be a special type of the sharp variety. The *kirsoulkos* might therefore have assumed the general shape of a hook (created from a stylus) from third century Ephesus, now in the Römisch-Germanisches Zentral Museum, Mainz (Fig. 20, 4th from left).⁴¹⁸

Paul, following Oribasius, exposes the varix with ἀγκίστροις or sharp hooks and τοῖς ὑδροκηλικαῖς ἐπικαμπέσι κοπαρίοις (6.82). Elsewhere the latter seem to be a kind of spatula, not a hook (see *Koparion* and *Hudrokelikon Koparion* under Probes). In Aëtius' account, as rendered in Cornarius' Latin translation, the only instrument mentioned by name is a blind/blunt hook or *caeco uncino* to raise the vein prior to ligation (14.84).

Lithotomy Hook

We only meet the lithotomy hook (λιθουλκός/*lithoulkos*) in three later Greek authors.⁴¹⁹ Aëtius (16.111) and Paul (6.60.2) mention but do not describe the instrument in their treatments of lithotomy.⁴²⁰ With only the name to go on, some have conceived of the instrument as a kind of forceps, on the analogy of the βελουλκός, clearly a forceps for withdrawing impacted arrow heads, etc.⁴²¹ Oddly, Oribasius *Coll. Med.* 45.6.2–9 was ignored in the debate. His testimony would seem to be decisively in favor of a hook. In cases of the stone-like tumor poros/tophus, Oribasius cuts through the overlying tissue, retracts the sides of

416 ἔπειτα λαβόντες ἀγκίστρα τῶν σφόδρα μικροκαμπῶν, καλουμένων κίρσουλκων, γαμμοειδῆ κατὰ τὴν καμπήν, καὶ καταπεύραντες ἐπιπολῆς εἰς τὸ δέσμα κατὰ τὸ ἐπιφανέστατον τοῦ κίρσου μέρους παρὰ τὴν ἐγγράραξιν τὴν σημειώδη πλάγιόν τε παρὰ τὸ σκέλος παρατείναντες αὐτὸ καὶ ἐνελήσαντες τῇ καμπῇ τὸ δέσμα—ἐμβαλοῦμεν διαίρεσιν εὐ μάλα μικράν—.

417 So Milne (1907) 135–6.

418 Künzl (1983a) 47(15.9). For fuller treatment see Bliquez (1985), 120–21.

419 There is also a reference in the Latin veterinary tract *Mulomedicina Chironis* 229: *caucolum lithulco exues*.

420 For the λιθαναβολεύς employed in Aëtius 16.110.11, see Hook for Removal of Accretions from Uterus, under Gynecological and Obstetrical Instruments.

421 Paul 6.88.1–3. For fuller treatment see Bliquez (1985) 119–121.

the incision with sharp hooks and then prys up the tumor “with the dissector of the scalpel or the bend of either a bone lever or the *lithoulkos* (τῇ τοῦ σμιλίου λαβῇ ἢ ἀναβολέως ἢ λιθουλκοῦ καμπῇ).” The word καμπή (‘bend’) suits a hook much better than a forceps; hence its association with the ἀναβολεύς or bone lever, a miniature crowbar which features such a bend on its ends (see below under Bone and Tooth Instruments). Note too the use of καμπή in Oribasius’ description of the varix extactor, itself a type of offset hook. Finally, λιθουλκός, in the sense of ‘hook’, perfectly reflects the flattened hook (*uncus*) with a roughened interior used by Celsus to extract bladder stone (7.26.2K–L). He says:

If the stone is big, it should be engaged on its upper part by the hook (*uncus*) made for this purpose. This is fine at its terminus, which is beaten into a wide semicircular shape, smooth on its outer side, where it comes into contact with tissue, but rough on its interior where it engages the stone. The hook/handle should be on the long side; if short it cannot supply the force for extraction.⁴²²

Lithoulkos must also designate the same type of hook when mounted on the *lithotomon*, the knife used in lithotomy (see above under Other Cutting/Puncturing Instruments).

The sum of lithotomy hooks independent of a blade (i.e., the *lithotomon*) includes: a specimen in Mainz, two in Cambridge, two in Rome, one in Devnja, one in Rimini (Fig. 11.11)⁴²³ and, possibly, one in the Meyer Steineg collection said to be from Ephesus (Fig. 76.2).⁴²⁴

422 *Si maior (calculus), iniciendus a superiore <ei> parte uncus est eius rei causa factus. Is est ad extremum tenuis, in semicirculi specie <m> retusae latitudinis, ab exteriore parte levis, qua corpori iungitur, ab interiore asper, qua calculum adtingit isque longior potius esse debet: nam brevis extrahendi uim non habet.*

423 For the Mainz specimen (combined with bifurcated retractor) see Künzl (1983b) Taf. 60.3; for those in Cambridge, one combined with a flat roughened spoon and one perhaps also functioning as an elevator, see Künzl (1983b) Taf. 63.2 & 3. For those in Rome (Museo Nazionale Romano Inv. nos. 65838 and 65839) see Jackson (2010) 404–406. The specimen in Devnja was noticed by Minchev (1983) 145 and now is published by Kirova (2002) 76. For Rimini see Jackson (2009b) 85, 89. The two specimens vouched for by Milne (1907, p. 147) in the Naples Museum should be dismissed, as they do not answer to the descriptions in the literature and, as matters now stand, cannot be traced to any medical contexts in Pompeii or Herculaneum.

424 This piece in the Meyer Steineg collection (Jena) may be Byzantine; see Künzl (1991a) 48(29&30), (1991aa) 1 533 (29&30), and (1992) 202–3. Its decor links it with a cranioclast in the collection, suggesting that it was a birthing hook. Of course it could have done double duty.

Also to be included in this class are four blunt two-pronged retractors included in instrumentaria focused on lithotomy. One is in Cambridge (GB) and one in Mainz (Fig. 20, 3rd from rt.), the latter being combined with the 'flattened' type just discussed.⁴²⁵ A third is preserved in Nijmegen (Fig. 89, ensemble lower rt.), and yet a fourth in the Museo Nazionale Romano.⁴²⁶

Most recognizable lithotomy instruments have only become known since 1983.

Finally, we should note a type of scoop/hook with a ridged as opposed to roughened surface that occurs in the Cambridge set (Fig. 41). Its construction closely resembles that of the levers used for bone work, though bone levers are more sturdily constructed. (See Bone and Tooth Instruments, s.v. Bone Lever/Elevator.) Still, because it is included in an instrumentarium weighted toward lithotomy, it most likely played a role in that surgery. That leads to the possibility that the roughened plates on bone levers themselves could be used as *lithoulkoi*, especially as one and perhaps two also occur in the Cambridge set.⁴²⁷

In the brief description of lithotomy in Pseudo-Galen, *Intro. or Physician* 14.787K = Petit 19.12, the instrument for removal of the stone is called λιθολάβος/*litholabos*. In view of the fact that the name occurs nowhere else, this is most likely only another name for the lithotomy hook. On the other hand, the termination -λάβος elsewhere applies to forceps types (e.g. σαρκολάβος), and some surviving forceps with narrow jaws, extended and dentated, may be suitable, one such occurring in the Cambridge set.⁴²⁸

Bone and Tooth Instruments

Saw

We find the surgical saw (πίλων in Greek, *serrula* in Latin) employed, as we might expect, in the amputation of limbs. Both Celsus (7.33) and Paul (6.84 [Leonides]) describe its use for this purpose, while Oribasius preserves extracts from Antyllus and Heliodorus detailing use of the saw in removing sections of rib corrupted by fistula (*Coll. Med.* 44.20.18). At some point a special saw seems to have been developed for ribs, as the term πλευροπιστήρ occurs on *Lists*.⁴²⁹ The authors cited recommend retracting the flesh with bands or straps

425 Künzl (1983b) Taff. 60.3 and 64.3.

426 For Nijmegen see Künzl (1983a) 94(75.12); for Rome see Jackson (2010) 408.

427 Künzl (1983b) Taf. 63.3 & 65.3.

428 Künzl (1983b) Taf. 63.1.

429 Schoene (1903) 283; Bliquez (1984) 201; Fischer (1987) 37(36). We also find πριστήρ alone: Fischer (1987) 33(41), 37(41).

so the saw can be manipulated without inhibition. A few details as to the saw's appearance occur in Galen's commentary on the Hippocratic work *Fractures*. Galen here applies the terms ὀδοντωτός and μαχαίρωτός in distinguishing two distinct kinds of πρίονες, the first of which was serrated,⁴³⁰ while the other must have assumed the shape and size of a knife, with perhaps moderate serration. That surgical saws were relatively small is indicated by Celsus' preference for the diminutive form, *serrula*.

We can produce few surviving examples with confidence. The fact that most saws were probably of iron and steel is doubtless a factor: their thin blades will have been especially vulnerable to rust and decomposition. A copper alloy specimen in the Meyer-Steineg collection is an attractive candidate; unfortunately, there are so many problems associated with this ensemble that one cannot guarantee this saw's genuineness.⁴³¹ Securely documented is a curved iron saw with fine teeth recovered in the fabulous Rimini find. It answers reasonably well to Galen's μαχαίρωτός or 'knife saw' type (Fig. 45, rt.).⁴³² A claim has also been made for a fragmentary specimen of copper alloy recently excavated at Alliano.⁴³³

As we have seen, the term πρίων occurs several times in the *Hippocratic Corpus* but always in the sense of a crown drill for trephining (see immediately below).⁴³⁴

Apart from instruments, evidence for amputation is provided by skeletal material from burials at Ostia (2nd century CE) and Ephesus (2nd century CE), as well as by a prosthetic lower leg from a grave at Capua (late 4th–early 3rd century BCE).⁴³⁵

430 *Comm. Hipp. Fractures* 18b.331K. Oribasius' name for the blade, λεπίς (otherwise meaning 'scale of a fish', 'shaving or flake of copper, snow, etc.'), probably also reflects serration.

431 Künzl (1991a) 42–43(15) and (1991aa) I 530(15).

432 Jackson (2005) 98 & Fig. 5.1 (1) and (2009b) 85, 89. Jackson (1997a) 1473 also views favorably a small saw in the Stanway instrumentarium, a set of Celtic tools showing Roman influence. The saws cited by Milne ([1907] 130–131) in the British and Guildhall Museums cannot be traced to ancient surgical instrumentaria and in 1985 I could not find the "surgical saws of steel" he says he found in the Naples Museum (Bliquez, Jackson [1994] 4 (V), 72).

433 Baykan (2012) 152(323) & 206 Fig. 20 (reconstruction with handle).

434 Paul (6.90.7) says, "The Moderns' condemn surgery performed with saws and crown drills as unsound" (ἡ δὲ διὰ τῶν πρίωνων τε καὶ χοινικίδων χειρουργία τοῖς νεωτέροις ὡς μοχθηρὰ διαβέβληται). Surely the Hippocratic method of trephining with crown drills is what "The Moderns" are rejecting. Milne [1907] 130) thought that by πρίων Paul was distinguishing "flat cranial saws" from crown drills in this passage. But [Hippocrates] uses πρίων as well as τρύπανον for the crown drill and I doubt Paul is making any distinction here.

435 Weaver, Perry, et alii (2000) 686; Kanz, Grossschmidt (2006 & 2009); Bliquez (1996) 2667–2673.

Drills

The literary sources of the Empire give us a fairly full picture of the situations for which drills were used to bore into the skull and other parts of the skeleton. Their principle function was to remove damaged or diseased bone. Conditions included: bone made carious by ulceration or fistula (Celsus 8.2.4; Oribasius, *Coll. Med.* 44.20.12 [Antyllus/Heliodorus]; Paul 6.77.3), skull fracture (Celsus 8.4.14; Galen, *Meth. Healing* 10.446–447K = J-H 2.218–221; Pseudo-Galen, *Intro. or Physician* 14.783K = Petit 19.5; Oribasius, *Coll. Med.* 46.11.11–13; 46.21.15 & 22 [Galen]; Paul 6.90.5), bony calluses (epiphyseal), especially on the head (Oribasius, *Coll. Med.* 46.29.8 [Heliodorus]); fistula lachrymalis/aegilops (Galen, *Cmpds. by Place* 12.821K [Archigenes]; Paul 6.22.1), and imbedded missiles (Celsus 7.5.4B; Paul 6.88.5). In addition to, or in conjunction with these conditions, they were deployed to prepare diseased bone for cauterization (Celsus 8.2.4), to relieve hydrocephalus (Aëtius 15.12.76 [Leonides]), to release suppuration below the skull and behind the ribs (Celsus 8.4.13–14; Oribasius, *Coll. Med.* 46.16.1–3), to relieve aching teeth caused by fever (Galen, *Cmpds. by Place* 12.863K), and even to treat epilepsy (Aretaeus, *Care Chron. Diseases* 1.4.3 and Caelius Aurelianus, *Chron. Diseases* 1.4.143 [Themison, with disapproval]). In a parasurgical procedure a stubbornly clinging cupping vessel might be removed by boring to break the pressure of the vacuum (Oribasius, *Coll. Med.* 7.16.12 [Antyllus], *Syn.* 1.13.2; Aëtius 3.20.9; Paul 6.41.3).

The drill bits were of two main types. Celsus' account (8.3) is particularly detailed. He says that one type, used for shallower drilling over a limited area, was circular or crown shaped and equipped with a serrated cutting edge, exactly like a saw (*imis oris serratum*). This type he calls a *modiolus*, adding that the Greek name was *choinikis* (χοινίς).⁴³⁶ Celsus reveals that the version he knew also had a removable center pin (*clavus*) to keep the instrument in position until the circular section had begun to bite. Under some circumstances a nick might first be made by the angle of a chisel (*angulo scalpri*) to receive the pin. To facilitate rotation, milk or rose oil might be applied (8.3.2–3).

The second type of drill, for encompassing more extensive disease or for deeper penetration of the skull, Celsus calls a *terebra*.⁴³⁷ Of this he says there were two kinds: one resembled the drill used by artisans, like smiths and carpenters, while the other was similar but lengthier (*capituli longioris*) and expanded immediately above its pointed tip (*dein subito latius fit*) before it narrowed again. Celsus' 'expansion' may refer to the series of 'prominences'

436 Spelled χοινίς by Celsus. Galen, *Meth. Healing* 10.448K = J-H 2.220–221, *Hippocratic Glossary* 19.126 & 129K and Paul 6.90.7 give the orthodox spelling.

437 *Terebra medicinali* also designates the drill used by veterinarians for fistula; see *Mulomedicina Chironis* 665.

(ἐξοχαί) above the tip mentioned by Paul and/or to the περιφερής τις ἕνυς (a term usually designating the fellow of a wheel or rim of a shield) attested by Galen.⁴³⁸ What is clear is that the expansion, prominences or rim acted as a barrier to insure that the drill only sank into the bone to a limited extent. This ‘collared’ type of drill must, therefore, have been intended to penetrate deeper than the model previously described. Galen and Paul call it τρύπανον ἀβάπτιστον because it could not sink (βαπτίζεσθαι) so deeply as to injure the brain. It seems in both of these drill types that we are dealing in bits with pointed tips, the tip being called αἰχμή or ἄκμή by Oribasius (*Coll. Med.* 46.11.7, 46.29.8) and Paul (6.90.5), ὀξύ or ἄκρον πέρας by Galen (*Meth. Healing* 10.447K = J-H 2.220–221), and *acutus mucro* by Celsus.

While the term *choinikis* applied strictly to the crown drill, the general term in Greek for the surgical drill was τρύπανον/*trupanon*. Both terms make their way onto *Lists*.⁴³⁹ In what follows, I shall refer for the sake of convenience to the circular or crown drill as a trephine and to the second type as a trepan.⁴⁴⁰

We may here add a few additional details re nomenclature. As the preferred Greek term for surgical drill, τρύπανον, might mean either the trephine or the trepan, distinction was only achieved by descriptive adjectives or by context.⁴⁴¹ As well as χοινικός, the diminutive χοινίκιον may have occurred⁴⁴² and in addition to τρύπανον we also find τρυπάνιον (Galen, *Cmpds. by Place* 12.821K) and τρυπάνη (Oribasius, *Coll. Med.* 44.20.12 [Antyllus, Heliodorus]). Other terms include κεφαλοτρύπανον (Pseudo-Galen, *Intro. or Physician* 14.783K = Petit 19.5, viewed as old fashioned), τέρετρον (Aretaeus, *Care Chron. Diseases* 1.4.3), and the Hippocratic carryover, πρίων (Paul, 6.90.7). The veterinary *Hippiatrica* document trepanning with a σχαστήριον for growths on shoulder or neck.⁴⁴³

Trephining/trepaning the skull is of course a very ancient procedure and one practiced in many cultures. Among Greeks and Romans the motive was always rational; i.e. the operation was not to release demons but to treat the natural sequelae arising from a blow, etc. As we have seen, the Hippocratic

438 Paul 6.90.5; Galen, *Meth. Healing* 10.446–447K = J-H 2.218–221.

439 Schoene (1903) 283; Bliquez (1984) 203.

440 The term trepan is sometimes applied to both types as in the *Oxford English Dictionary* and Dorland's *Illustrated Medical Dictionary* (28th ed., 1994). I follow Spencer's distinction in his Loeb translation of Celsus, vol. 3, 496–497.

441 E.g., Galen *Hippocratic Glossary* 19.129K: τρύπανον ὀξύ καὶ εὐθύ.

442 So Pseudo-Galen, *Intro. or Physician* as read in Kuhn 14.783K = Petit 19.4 who reads χοινικήσι (nom. χοινικής?). *LSJ* lists neither.

443 *Ber.* 24.3.10, 26.9.11 & 18.11.

procedure was to use crown drills to trephine out a circular piece of skull in consequence of fracture. This procedure obviously continued in use, although Imperial authorities are cool to it or, as in the case of Pseudo-Galen, erroneously think it altogether abandoned (*Intro. or Physician* 14.783K = Petit 19.5). Trephined skulls of the 3rd to 2nd centuries BCE recovered at Celtic sites may have been bored with Greek crown drills.⁴⁴⁴ The survival rate in these instances is less than in the cases of skulls from these same sites treated by cutting and scraping. This may account for declining enthusiasm for use of the crown drill. Ironical then that the only surviving crown drills date to the time of the Roman Empire (see below).⁴⁴⁵

According to the literary sources, another method of treating skull injuries became more popular, that of drilling holes in a circle with a trepan and then breaking down the intervening bone with chisels. This procedure is first described by Celsus; later Galen and Paul provide detailed accounts, Paul observing that the proper distance between the holes is the length of a good-sized *puren*.⁴⁴⁶

Trephines and trepans could be rotated by hand;⁴⁴⁷ or they could be spun more rapidly by wrapping them with a strap or thong that could then be drawn by the free hand. Details in the sources on these maneuvers are scarce; but clearly the most efficient method of operating, and probably the one generally preferred, was to insert the drills into chucks, wrap them with a thong and then work the strap back and forth with a bow, exactly as the drills employed by wood and metal workers, from whom this method must have been borrowed. A 5th century BCE Attic red-figure vase showing a carpenter at work illustrates the process quite well.⁴⁴⁸ Celsus first mentions the strap/thong (8.3.2: *habena—convertitur*), while references to the bow, regularly termed ἄρις (*aris*),

444 All these sites (Dürrenberg, Katzelsdorf, Guntramsdorf) are in Austria. See Künzl (1995) 222–223 and Breitwieser (2003) 149.

445 For a summary of physical evidence for trephining at the time of the Empire, including two skulls found in Pompeii, see the summary provided by Cruse (2004) 187, 189–191. It is disappointing that, in spite of the rich trove of surgical tools recovered there, Pompeii yields no drills, at least up to now.

446 Celsus 8.3.4–5; Galen, *Meth. Healing* 10.445–447K = J-H 2.214–219; Paul 6.90.5.

447 I am here thinking of an arrangement rather like an auger. To be sure there is no ancient evidence at all for a crank shaped brace to drive the bit, but such are found in modern surgical catalogues; e.g. *Catalogue of Surgical Instruments of Superior Quality*, Biddle and Crowther Inc. 321 Seneca St., Seattle, Wa. 1935 (24th ed.), p. 137.

448 Gallatin Ptr. as shown by Boardman (1983) fig. 192.

occur in Galen and Oribasius, the name eventually emerging on *Lists*.⁴⁴⁹ The speed with which the drills could be rotated by the bows resulted in such friction and heat that Celsus, as Hippocrates before, recommends that they be periodically removed and cooled in water (8.3.7).

The diminutive forms referenced above show that the sizes of trephines and trepans clearly varied to meet changing situations. So does other descriptive terminology such as the fine trepan (λεπτῷ τρυπάνῳ) Galen recommends for toothache (*Cmpds. by Place* 12.863K) and the fine small model (λεπτῷ τρυπανίῳ) he records that Archigenes used to pierce the nasal bone in draining fistula lachrymalis/aegilops (*Cmpds. by Place* 12.821K).⁴⁵⁰ These passages recall the Hippocratic recommendation that a μικρόν τρύπανον be employed for skull injury on a child and look forward to the τρύπανον λεπτόν mentioned in veterinary tracts of the Empire to relieve flatulence in horses.⁴⁵¹ Especially noteworthy is Galen's injunction that the surgeon have available τρύπανα ἀβάπτιστα of different size, in anticipation of different thicknesses of bone (*Meth. Healing* 10.447K = J-H 2.220–221).

Milne thought that for *aegilops* Archigenes employed a hand-operated trepan, citing a small beautifully damascened handle among the instruments of the oculist Severus as a possibility.⁴⁵² However, the tell-tale therapeutic end of the instrument is missing and, in any case, except for its decor, the piece differs in no way from similar handles in the same instrumentarium which once mounted a scalpel blade at one end and some kind of iron/steel needle at the other. Still, Archigenes may have been referring to some sort of hand drill/needle or a fine lancet.

As to material survivals, no example of a hand-operated *modiolus*/trephine can be authenticated, though Meyer Steineg made a claim for a piece in his collection.⁴⁵³ This accords with the lack of testimony to its use in the literature. The same is true of bow driven trepan bits, as not one has been recovered in a surgical context.⁴⁵⁴ The reason may be that bits of this kind were of iron and, like other tools of this material, have rusted away.

449 Galen, *Hippocratic Glossary* 19.85K; Oribasius, *Coll. Med.* 46.11.7; *Lists* = Schoene (1903) 281; Bliquez (1984) 198. 'Hippocrates' refers to the bow-drill in the treatise *Joints* but not in a surgical context 4.12.21L.

450 Cf. Paul 6.22.1.

451 *Hippiatrica Ber.* 46.1.9.

452 Milne (1907) 133; Künzl (1983a) 65(36.25).

453 The specimen he classified as Assyrian is modern; see Künzl (1991a) 32–4, 62–3(75) and (1991aa) II 191–192(75).

454 It has been suggested that a pointed iron shaft in the Bingen instrumentarium may have served as such: see Künzl (1983a) 84(58.9); Jackson (2005) 108–9.

A pair of crown trephines made of copper-alloy have come to light in the instrumentarium of the Bingen surgeon (Fig. 47).⁴⁵⁵ They feature the removable centering pins mentioned by Celsus. One is slightly larger than the other and the number of teeth differs on each. One preserves the perforations through which was passed the strap/thong of the bow, but neither is equipped with the chuck to be gripped by the operator. This suggests that chucks may have been made of perishable material, most likely wood.⁴⁵⁶ Preserved along with these crown drills is the bow or *aris* that drove them.⁴⁵⁷ In contrast to bits, bows survive in abundance. In addition to the specimen from Bingen six other examples are known to date. Their handles are perforated, so as to mount the thong/strap that ran through and around the crown drills to drive them. Two have been recovered recently in the Domus 'del chirurgo' at Rimini (Jackson [2005] 107; [2009b] 83 & 88), one in the Colophon instrumentarium (Caton [1914] 116 = Fig. 46), one in a house in Marcianopolis (Minchev [1983] 146; Kirova [2002] 81 & 86), and one each in the British Museum (Caton [1914] 117) and in the Berlin Antikenmuseum (Jackson [2005] 105, unprovenanced). The latter two and one of the specimens from Rimini feature (Fig. 49.20) as décor the snake's head representing Asclepius that is familiar on tri-valve uterine specula and a few other other surgical tools.⁴⁵⁸

If the story is not apocryphal, Plutarch narrates an actual instance of trephination or trepanation, this involving an unnamed ambassador to Bithynia ridiculed by Cato the Elder (*Cato Major* 9).

455 Künzl (1983a) 84(59.1–5); Jackson (2005) 105–6. A toothed iron cylinder from Niederbieber and a toothed iron tube from Cirencester deserve mention: see Gaitzsch (1980 and 1981) and McWhirr, Viner, Wells (1982). They are probably not surgical. The former is large, broad and thick (L. 65 mm. Diam. 55 mm.) and the latter small, slender and thin (L. 32.5 mm., Diam. 9 mm.). Compare the Bingen diameters of 22 and 25 mm., which correspond favorably to the diameters of the drilled sections of the skulls from Austria (17, 19, and 20 mm). Thus Niederbieber and Cirencester seem too large and too small respectively for the purpose, and neither was found with complimenting tools, e.g., a drill. I owe this information to Ralph Jackson.

456 For chucks see the depiction of a carpenter at work by the Gallatin Ptr. in Bordman (1983) fig. 192, and the tombstone of Philonicus and Demetrius from Frascati (Jackson [2005] 109 Fig. 5.6).

457 Künzl (1983a) 84(59.6), 85(60).

458 E.g., on two trivalve specula from Pompeii; see Bliquez, Jackson (1994) 188–189(292, 293) and Figg. 71 & 72.

Guard/Protector (Meningophulax)

In operations involving cutting or sawing bone, it was essential to keep underlying parts from being damaged (Paul 6.77.4). To this end a type of guard was applied, called *μηνιγγοφύλαξ* (*meningophulax*) by both Greeks and Romans.⁴⁵⁹ Celsus twice also uses the Latin circumlocution *membranae custos* (8.3.8 & 8.4.17). The name *meningophulax* occurs as well on *Lists*.⁴⁶⁰

Its name ‘protector of the meninges’ reflects the use of the instrument in skull surgery, where the application of a chisel positioned at an angle presented special dangers (Celsus 8.3.8; Paul, 6.90.5). But we also hear of the *meningophulax* as a guard in operations on bone corrupted by fistula (Oribasius, *Coll. Med.* 44.20.18 [Antyllus, Heliodorus]; Paul 6.77.4), in removal of fragments of ribs fractured inwardly (Paul 6.96.3 [Soranus]) and in weapons removal (Paul 6.88.8). In addition to protecting delicate parts of the anatomy, the *meningophulax* also served to steady bone for excision: e.g., a fractured clavicle (Paul 6.93.3), a rib (Oribasius, *Coll. Med.* 44.8.2), and the skull in trepanning (Celsus 8.3.8–9; Oribasius, *Coll. Med.* 46.11.27–28).⁴⁶¹ In the latter case it also was used to lift out the section of skull cut through. Galen likewise finds the *meningophulax* useful in cutting through ribs of animals (*Anat. Proc.* 2.686K = 11.525Gar).

The *meningophulax* is described as a plate of copper alloy (ἔλασμα/*lammina aenea*). Celsus (8.3.8) says that it is “initially somewhat curved and smooth on its outer side” (*prima paulum resima, ab exteriori parte levis*). He goes on to say that the smooth side faces the brain, so it is clear which side he means by *exterior pars*. *Resima* means ‘turned up’ or ‘turned back’, seemingly indicating that the end (*prima*) of the plate was slightly angled convexly underneath or on the *exterior pars* so as to make it easy to slip between the brain or other delicate parts and the bone to be excised. On the whole the *meningophulax* must have resembled a spatula because we are told that a spatula could be substituted for it. Galen, for example, once mentions a broad *spathomele* as an alternative to a ‘fine’ model (*Anat. Proc.* 2.686K = 11.525Gar: *μηνιγγοφύλακα λεπτόν ἢ σπαθομήλην πλατείαν*). And in excision of the rib Oribasius likewise deploys the ‘flat of a *mele*’ or the *meningophulax*, referring to their plates as *platu* (“the flat part”) and *elasma* (“plate”) respectively (*Coll. Med.* 44.8.2: *πλατὺ μήλης ἢ μηνιγγοφύλακος ἔλασμα*). In operating for fistula the same author even accepts

459 The term is also used of a linen dressing by Oribasius (*Coll. Med.* 46.19.5 & 7).

460 Schoene (1903) 282; Bliquez (1984) 201; Fischer (1987) 35(12).

461 In trepanning Galen several times notes that unduely pressing the *meningophulax* on the brain produces torpor, lethargy, etc.: *Doct. Hipp. Plat.* 1.6.6 (De Lacy), *Aff. Parts* 8.232K, *Comm. Hipp. Epid.* 3, 17a.522K. See also Alexander of Tralles (*Therap.*, 1.535.2).

wooden spatulas in place of the *meningophulax*.⁴⁶² To sum up, it seems that the *meningophulax* was a spatula shaped plate, slightly convex at the tip of its underside and, like a spatula, surely mounted on a handle, like its modern counterparts.⁴⁶³

Milne depended on post-classical authorities for illustration. Lately, Ralph Jackson has proposed as a candidate the instrument traditionally classified as a bunt retractor (*tuphlankistron*). The kite-like or leaf-shaped, slightly convex, plate positioned at an angle to its handle fits well with Celsus' stipulations. If the *tuphlankistron* also served as a *meningophulax*, it would have been so named when used as such. Assuming *tuphlankistron* and *meningophulax* are the same tool, nine examples survive (Fig. 3, middle row, 3rd from rt.; Fig. 49.17).⁴⁶⁴

Only *Lists* attest a 'gut guard' or ἐντε<ρο>φύλαξ (*enterophulax*).⁴⁶⁵ On analogy with the μηχανοφύλαξ, which protected underlying tissues and organs during sawing and trephining operations on bone, the ἐντεροφύλαξ will have been a plate to protect the inner organs of the abdomen under similar conditions. We have noted that Paul in fact employs the μηχανοφύλαξ in rib surgery (6.77 & 96), which indicates that the ἐντεροφύλαξ did not differ appreciably, if it differed at all. We may simply have two names for the same tool.

Chisel and Gouge

The chisel (ἐκκοπέυς, *scalper/scalprum*)⁴⁶⁶ is mentioned frequently by Imperial and early Byzantine authors and appears on *Lists*.⁴⁶⁷ Oribasius names its parts,

462 Cf. also *Coll. Med.* 44.20.18: ... μηχανοφύλακα ὑποβαλόντες ἢ σπάθην τῶν ξυλίνων ...

463 For modern examples see the *Catalogue of Surgical Instruments of Superior Quality* published by the Seattle firm of Biddle and Crowther (1935, 24th ed. 116). Milne (1907) sites a sixteenth century example from the *Chirurgia* of Vidius (Pl. XL.3).

464 See Jackson (1986) 142–143 and the list he provides there. To these add three more found at Rimini: Jackson (2003) 314 & (2009b) 84, 88.

465 Schoene (1903) 282; Bliquez (1983) 196; Fischer (1987) 37(38).

466 Celsus unfortunately uses this same term for chisel, gouge and scraping tool/curette (*xuster* in Greek). In several instances he is clearly referring to the operation of a chisel: these are 8.4.14, where he employs a *scalprum planum*, 8.10.7G and 8.3.2 & 8, where in describing trephining and trepaning of the skull he mentions the *angulus scalpri*. In the same operation he may mean a chisel when he uses a *scalper excissorius* to cut through the intervals of bone left after the trepan has been used to create holes in a circle around a damaged portion of skull. Galen in treating this procedure allows for both the chisel and the gouge (*Meth. Healing* 446–450K = J-H 2.218–227). For second century remains at Ephesus thought to be those of gladiators, including a possible instance of skull surgery with a sharp instrument, see Kanz, Grossschmidt (2006 & 2009).

467 It appears as ἐγκοπέυς/*ecopetis*; see Schoene (1903) 282; Bliquez (1984) 199; Fischer (1987) 34(10).

calling the handle λαβή (*Coll. Med.* 46.11.19 and 28), the blade σμιλίον, and its edge ἀκμή (*Coll. Med.* 44.8.9).

The primary function of the chisel was to chip away pieces of bone, as in the intervals of bone left in trepanning as described above. In addition it was applied in cases of bone corrupted by fistula (Oribasius, *Coll. Med.* 44.20.11, *Ecl. Med.* 100.6; Paul 6.77.3), weapons removal (Paul 6.88.5), skull and clavicle fracture (Celsus 8.4.14–16; Galen, *Meth. Healing* 446–450K = J-H 2.218–227; Pseudo-Galen, *Intro. or Physician* 14.783K = Petit 19.4; Oribasius, *Coll. Med.* 46.11.23 & 28 and 12.2; Paul 6.93.3), diseased rib (Oribasius, *Coll. Med.* 44.8.7–9), decaying cranial tissue or teredonismos (Oribasius, *Coll. Med.* 46.22.16 [Heliodorus]), excessive callus as a sequela to fracture (Paul 6.108.1), and superfluous bone growth (Oribasius, *Coll. Med.* 46.29.8 [Heliodorus]). We also find it employed in amputation of supernumerary digits (Paul 6.43.1), in chipping off superfluous fractured bone before pushing bone back into position (Paul 6.107.2), in the refracturing of bone in cases of distorted union (Oribasius, *Coll. Med.* 47.15.5; Paul 6.109.1), in tooth extraction (Paul 6.28.1), and in the animal dissections performed by Galen (*Anat. Proc.* 2.440–1K = I.233Gar and 592K = II.411Gar). Parasurgically, it might be deployed in the forced removal of a finger ring (Oribasius, *Coll. Med.* 47.17.4).

Finally, Celsus (7.26.3B) describes a method of lithotripsy performed by one Ammonius, a specialist in lithotomy. This involves positioning bladder stone in a scoop/hook (uncus) and splitting it by striking it with “an instrument of moderate thickness, slender and blunt at its terminus” (*ferramentum—crassitudinis modicae, prima parte tenui sed retusa*).⁴⁶⁸ The instrument at issue is surely a chisel.

As with many other instruments, chisels were of various sizes and shapes. Galen refers to ‘stout and sharp models’ (ἰσχυροὶ τε ἄμα καὶ ὀξεῖς, *Anat. Proc.* 2.592K = II.411Gar) for dissecting. These he once compares to carpenters’ axes.⁴⁶⁹ Something resembling this type may be what Oribasius has in mind when he equates an “extremely heavy” scalpel with the blade of a chisel (διὰ σμιλίου βαρυτάτου... ἢ ἀκμῇ σμιλίου τοῦ ἐκκοπέως: *Coll. Med.* 44.8.9) or recommends ‘square’ chisels (ἐκκοπεῖς τετράγωνοι, *Coll. Med.* 44.20.11 [Antyllus, Heliodorus]). A narrow but still sufficiently thick type (τῶν στενῶν καὶ πάχος ἱκανὸν ἐχόντων) he calls a γομφωτήρ (*gomphoter*) at *Coll. Med.* 44.20.15. *Gomphoter* suggests a

468 For lithotripsy in Byzantium see S.G. Makaretos et alii, “The First Record of Lithotripsy in the Byzantine Era,” *Brit. Journal of Urology* 74 (1994) 405–8 with J. Scarborough’s review in *Soc. Anc. Med. Revue* 23 81.

469 *Anat. Proc.* 2.709K = II.553Gar: ἐκοπεῦσι τοῖς ἰσχυροῖς χρώμενος ἢ τοῖς τῶν τεκτόνων σκεπάρνοις...

bolt- or nail-like punch, which may be the same as the chisel mentioned by Paul as *μηλιωτός*, i.e. a chisel round and pointed like a simple probe (6.90.4–5).⁴⁷⁰ Finally, I take those chisels described by Oribasius (*Coll. Med.* 44.20.74; 46.11.17) and Paul (6.28.1) as ‘knifelike’ (*σμιλιωτοί*) to be finer models with thinner blades. Oribasius indicates on one occasion that these could be notched or clawed (*ὠνυχωμένον*: *Coll. Med.* 46.11.18).

In two instances, Paul speaks of *ἐκκοπεῖς ἀντίθετοι* (6.77.3, fistula; 6.107.2, protruding fracture). Here he apparently means chisels used in pairs. The idea seems to be that one chisel is used to steady the part being operated on by the other, as when Paul recommends that we chip away fragments of a clavicle with one chisel while using the other or a *meningophulax* to steady the bone (6.93.3). Galen appears to mean the same thing when he refers in the course of dissection to “two chisels acting in opposition to one another” (*ἀντιβαλλομένων δυοῖν ἀλλήλοις ἐκκοπέων*, *Anat. Proc.* 2.686K = 11.525Gar). Oribasius too refers to the use of two chisels in breaking down the intervals of skull between holes drilled by the trepan (*Coll. Med.* 46.11.17–25). He tells us that an attendant is needed to hold one of the chisels.

Usually the chisel was struck by a hammer (see below), but it may also have been driven by hand. Heliodorus seems to so indicate in treating a condition called *teredonismos* or cranial caries (Oribasius, *Coll. Med.* 46.22.14–16 [Heliodorus]):

When there is fatty ulceration or superficial decay, let scraping be approved/selected, so that not just the defective substance can be scraped, but so that by continuous scraping the dense surface of the skull can be eliminated... [In the case of decay with erosion of bone, when the skull is pitted] once again, after removal of intervening tissues, you have to perform something like a scraping operation with knifelike chisels...⁴⁷¹

While the shape and size of the surgical chisel are treated in the sources, nothing is said about its material makeup. Here archaeological finds fill in the picture. Several heavy-duty iron chisel blades are to be found in the Bingen

⁴⁷⁰ This makes more sense than taking *μηλιωτός* as a variant of *σμιλιωτός*, as do *LSJ*.

⁴⁷¹ λιπίσματος μὲν οὖν ὄντος ἢ ἐπιπολαίου φθορᾶς, ἐγκρινέσθω ξύσις, οὐχ ἵνα μόνον ἢ ἐπιλιπῆς οὐσία ξυσθῇ, ἀλλὰ ἵνα τῇ ἐπιμόνῳ ξύσει καὶ ἡ πύκνη ἐπιφάνεια τοῦ κρανίου δαπανηθῇ... πάλιν δεῖ μετὰ τὴν τῶν σωματῶν ἀναστολὴν ὁμοίον τι ξύσει δρᾶσαι διὰ τῶν σμιλιωτῶν ἐκκοπέων...

instrumentarium. Their now missing handles must have been of wood.⁴⁷² To these we may add a fine matching pair composed of flat iron blades mounted on octagonally sectioned handles of copper alloy from an Italian instrumentarium now in the British Museum (Fig. 3, middle row, 1st and 2nd from rt.), another such specimen from Pompeii, and a second pair from Xanten.⁴⁷³ This is probably the type Celsus envisages when he cuts away the overlying edge of a depressed skull fracture *plano scalpro* (8.4.14). In addition, we now have another 12 in the Rimini find, among them two sets of matching pairs. They feature, in the main, tanged blades of varying length, breadth and thickness inserted into copper alloy or wooden handles.⁴⁷⁴ The archeological survivals reflect the requirement in the literary sources that an instrumentarium contains a medley of hard iron/steel chisels for surgery and anatomical work.⁴⁷⁵

For the *kephalike smile* cited by Galen, see s.v. under Other Cutting/Puncturing Instruments.

The gouge was classed by Greeks as a type of chisel; hence it too bears the name ἔκκοπεύς. As its blade was concave in section, it was distinguished by being called ‘circular’ or ‘hollow’ (ἐκκοπεύς κυκλίσκος, ἐκκοπεύς κοιλὸς)⁴⁷⁶ and ‘hollowed at the end.’⁴⁷⁷ Galen regards it as a modern invention, meaning probably that it was developed in the Hellenistic period.⁴⁷⁸ Paul (6.90.4) notes that gouges could be wider or narrower:

472 Como (1925) 160 (6.6, 13 & 15). One of these (6) is tanged to accept a handle, like the gouge (7) in this set and gouges recovered in Rimini (see below).

473 Künzl (1983a) 42 (11.5) for Kallion and 84 (58.6) for Bingen; Künzl (1986) 494 (5) for Xanten; for Naples see Bliquez/Jackson (1994) no. 95, which is exactly like these and must have been surgical. The same is probably true of no. 94 a rounded handle tapering inward from its extremities. Unfortunately, the exact proveniences of both cannot be documented. The Bingen chisel may have been for carpentry, as it is somewhat larger than authenticated surgical models. There may be another example from Aschersleben (Fig. 38.3).

474 See Jackson (2003) 318. Among the standard chisels he includes, “an unusually diminutive pair and another notable pair with ornate sinuous handles. There are two large single-piece iron chisels with a solid square head, broad flat blade, and splayed cutting edge, and there are two heavy, tanged, broad-bladed iron examples, formerly with wooden or bone handles, that are effectively carpentry tools.” Fig. 49.19 shows one of the ornate chisels. See also now Jackson (2009b) 84, 88.

475 Galen, e.g., requires stout chisels of hard iron/steel (ἐκ σιδήρου σκληροῦ) for anatomical work on the skulls of oxen (*Anat. Proc.* 2.709K = 11.553Gar).

476 Galen, *Meth. Healing* 10.445K = J-H 2.214–215: τῶν κοιλῶν ἐκκοπέων οὓς καὶ κυκλίσκους ὀνομάζουσι.

477 Oribasius, *Coll. Med.* 46.21.17: . . . ἐκκοπέων εἶδός τι κεκοιλιασμένον ἐπὶ τῷ πέρατι.

478 In Oribasius, *Coll. Med.* 46.21.17 [Galen]: διὰ τοῦτο οὖν οἱ νεώτεροι τοὺς κυκλίσκους ἐξεύρον.

We will first cut around the bone with paired chisels, the hollow kind, starting first with the wider ones and changing to the narrower type ...⁴⁷⁹

We find the gouge mentioned exclusively in the context of skull fracture where it is used to chip away weakened bone and to clear the area to be cut through with the lenticular (see below).⁴⁸⁰ Paul makes it clear that, like the chisel, the gouge too could either be pushed by hand or struck by hammer.⁴⁸¹

Celsus in dealing with similar operations refers to a *scalper excissorius* (8.3.4–5). This name suits both chisel and gouge.

One of the iron blades in the instrumentarium of the Bingen surgeon is shaped like a gouge and it has been tempting to take it as such.⁴⁸² In any case, the recovery of three close parallels at Rimini insures that we now have authenticated models of the surgical gouge (Fig. 49.21). The Rimini specimens feature iron blades of varying gauge and profile.⁴⁸³ Jackson describes the best preserved as having “a very fine cutting edge, with rounded V-shaped tip at the end of a slim octagonal-sectioned stem.” Unfortunately, their wooden/bone handles “secured to the stem by means of a short tang and a small bronze collar” are now lacking.⁴⁸⁴ The Bingen specimen also features the same tang and collar.

Lenticular

A very specialized type of chisel was the lenticular, or φακωτὸς ἐκκοπέυς (*phakotos ekkopeus*). It was used exclusively for removing damaged bone in cases of skull fracture and featured a lentil (*phakos*) shaped guard; hence its name. Galen first mentions the instrument, describing its use and appearance this way:

479 ἀντιθέτοις ἐκκοπεύσι τοῦτο περιέλωμεν πρῶτον τοῖς κυκλίσκωτοῖς ἀπὸ τοῦ πλατυτέρου ἀρχόμενοι καὶ μεταμείβοντες τοὺς στενοτέρους ...

480 Galen, *Meth. Healing* 10.446K = J-H 2.218–219; Oribasius, *Coll. Med.* 46.21.15ff.; Paul 6.90.4–6.

481 See 6.90.6 where the chisel called lenticular (see below) is only applied after the appropriate area of the skull has been scraped all around by gouges: μετὰ τὴν ἐκ τῶν κυκλίσκων περιγλυφὴν ...

482 For similar examples see E. Künzl, *Die Alamannenbeute aus dem Rhein bei Neupotz*, = *Römisch-Germanisches Zentralmuseum, Forschungsinstitut für Vor- und Frühgeschichte, Monographien* 34.2 (Römisch-Germanisches Zentralmuseum, 1993: Typentafel 40 (NH 26 and 27). These particular tools were probably used by carpenters, but that hardly excludes the likelihood that such an instrument in the Bingen instrumentarium which features bone instruments like trephines and elevators was not employed in surgery.

483 See Jackson (2003) 315–318 Fig. 1.6; (2005) 110 with illustration 99 Fig. 5.1, 4.

484 Jackson (2009b) 84, 88.

Once you have exposed a portion (of fractured skull where the meninx has become detached), apply beneath it the chisel having at one end of its sharp blade a lentil-like projection. When you have engaged the flat part of the lentil-like projection along the meninx, striking with the small hammer, in this way divide the skull. This way of operating meets our every need. The meninx cannot be wounded, even by a drowsy operator, because it is only engaged by the flat part of the lenticular. And, if at any point the meninx does adhere to the skull, the round part of the lenticular separates the adhesion harmlessly. The (sharp part) of the chisel blade follows its lead from behind, dividing the skull. So, when you operate, you cannot find a quicker or safer way of trepanning (*Meth. Healing* 10.448–449K = J-H 2.222–223).⁴⁸⁵

What we have then is a type of chisel with a lentil-like button arranged longitudinally at one end of its cutting edge. This button protected and, if need be, separated the meninges while the sharp edge of blade sliced sideways horizontally through the bone. To allow for the trajectory of the lenticular a groove had to be gouged or a hole drilled if damage to the skull had not already created a proper opening. Although Galen was keen on this mode of operating, Paul felt that the safest and most common method was that of drilling holes in a circle and breaking down the intervening bone with hammer, chisel and guard, whether a spatula or *meningophulax* (6.90.5–6). For this reason the lenticular may have been a rare instrument, and it is not surprising that none had been recovered until the find at the Domus ‘del chirurgo’ at Rimini, a site so rich in instruments for bone work. Among them not one, but four iron specimens have been reported (Fig. 49.22 & 23).⁴⁸⁶ The lentil-like projections of each vary subtly.

485 ἦν δ' ἅπαξ ἓν τι γυμνώσης μέρος, ὑποβαλὼν ἐκκοπέα, τὸ μὲν φακοειδὲς ἐπὶ τῷ πέρατι προὔχον ἀμβλὺ καὶ λεῖον ἔχοντα, τὸ δὲ ὀξὺ κατὰ τὸ μήκος ὄρθιον· ὅταν στηρίξης κατὰ τῆς μήνιγγος τὸ πλατὺ τοῦ φακοειδοῦς, ἐπικρούων τῇ μικρᾷ σφυρᾷ, διαιρεῖν οὕτω τὸ κρανίον. συμβαίνει γὰρ ἐπὶ ταῖς τοιαύταις ἐνεργείαις πάντα ὅσων χρῆζομεν. ἢ μὲν γε μήνιγξ, οὐδ' ἂν νυστάζων τις ἐνεργῇ, τρωθῆναι δύναται, τῷ πλατεῖ μέρει μόνῳ τοῦ φακοειδοῦς ὁμιλοῦσα· καὶ ἦν προσέχεται δὲ πού τῷ κρανίῳ, καὶ ταύτης τὴν προσάρτησιν ἀλύπως ἀποσπᾷ τὸ περιφερὲς πέρας τοῦ φακοειδοῦς· ἔπειτα δὲ ἐξόπισθεν αὐτῷ ποδηγούντι, διακόπτων τὸ κρανίον ὃ ἐκκοπεὺς αὐτός. ὥστε οὔτε ἀκινδυνότερον οὔτε θάττον ἐνεργοῦντα τρόπον ἕτερον ἀνατρήσεως εὐρεῖν ἐγγχωρεῖ. This passage is copied by Oribasius (Coll. Med. 46.21.20–22) and Paul (6.90.6).

486 See Jackson (2003) 318 & 315 Fig. 1.5, (2005) 116–17 Fig. 5.1, (2009b) 84–85, 88–89. In 1907 Milne only had recourse to post-classical (actually Renaissance) authorities for purposes of illustration; Pl. XL.2 (after Vidus Vidius).

The skull of a hydrocephalic child recovered from a 2nd century burial near Fidenae is thought to reveal trepanation carried out with gouge and lenticular.⁴⁸⁷

Hammer/Mallet

There are several references to the hammer (σφῦρα/*malleus-um*) in the literature, including *Lists*.⁴⁸⁸ It is mentioned mainly in connection with injury to the skull, its purpose being to drive the chisel, gouge and lenticular. Testimonia to its use in skull surgery are provided by Celsus (8.3.4 and 8.3.9), Galen (*Meth. Healing* 10.448K⁴⁸⁹ = J-H 2.222–223), Oribasius (*Coll. Med.* 46.11.19 & 28), and Paul (6.90.4). No surprise then that Oribasius uses the term ‘head hammer’ (κεφαλικῶ σφυρίῳ).

In a parasurgical operation Celsus (6.7.9B) removes foreign bodies from the ear by tying the patient to a plank with his ear facing down and projecting off of the upper side of the plank supported in its middle but not at its ends. The extremity at the patient’s feet is then struck with a hammer, thus jarring the ear and removing the offending body. Paul mentions a similar succussion process but without the hammer (6.24.1).

Perhaps because surgical hammers were commonly of wood, they do not survive. In any case, no type especially designed for surgery can be authenticated, so it is unclear whether the surgical hammer differed in form from the general type.⁴⁹⁰ The sources cited describe it as being small (σφυρίον, μικρὰ σφῦρα, *malleolus*), which may have been its sole distinction.

Block

To provide a firm undersurface for cutting, chopping, and sawing, we hear occasionally of a block, formally called ἐπίκοπον/*epikopon* in Greek and in Latin.⁴⁹¹ Galen, for example, in exposing the rib of an animal for dissection says (*Anat. Proc.* 2.685K = 11.523Gar):

487 Mariani-Costantini et al. (2000). This case and still others are noted in the appropriately cautious treatment of Roman trepanation by Tullo (2010).

488 Fischer (1987) 36(23). Another name to consider on *Lists* is ἐπικρούστιον (Schoene [1903] 282). In its favor as designating hammer is *Herm. Mon.* 207.53: *epicrusterion malliolum*. On the other hand, Aëtius is witness to a φλεβοτόμον ἐπικρουστικόν (6.8.92 [Archigenes and Posidonius]). It too might be the ἐπικρούστιον of *Lists* (Bliquez [1984] 197).

489 Copied by Oribasius (*Coll. Med.* 46.21.20) and Paul (6.90.6).

490 Zervos (1932) figures a small copper alloy model (p. 53) now in the National Museum, Athens. Unfortunately, its provenience is unknown.

491 *Lists* preserves as well the diminutive ἐπικόπιον: Schoene (1903) 282; Bliquez (1984) 199.

When then you get a good view of the position of the rib you are going to dissect out, cut down along it, [and cut] all the tissue that lies under the body of the rib together with the skin, while the animal is making a sound. Use a block (*epikopon*). For want of a better term anatomists and surgeons alike use this term of a support for bodies positioned for cutting.⁴⁹²

So too Archigenes on amputation (in Oribasius, *Coll. Med.* 47.13.5):

(After appropriate preparations) we then place (sc. the part to be amputated) on something resistant that can be classified as a block and operate" (... ἐπιθέντας ἐπὶ τινος ἀντιτύπου τάξιν ἔχοντος ἐπικόπου ἐνεργεῖν).

These passages show that an *epikopon* (properly a butcher's block) was not a specially created instrument of surgery. Like drills, saws, bone levers and spatulas, it was simply an item incorporated into the surgical repertoire. When various materials and tools could be used to perform the supporting function Galen describes, we typically find them modified by the expression κατ' ἐπικόπου: 'as a block.'⁴⁹³ We may take as an example Paul's report on Leonides' approach to *rhacoma* or superfluous skin of the scrotum (6.67.1).

Leonides places the patient on his back and with a scalpel cuts away the excess using a small plank or a piece of dry hide as a block (κατ' ἐπικόπου).⁴⁹⁴

We several times hear that a *meningophulax*, a spatula (including one of wood), and the shaft of a probe, could act "as a block" in operating for various manifestations of anal fistula as well as on bone corrupted by fistula (Oribasius, *Coll. Med.* 44.20.18, 56, 66, & 77; Paul 6.78.4 [Leonides]). Oribasius even mentions a finger as backing for amputation of the peritoneum (*Coll. Med.* 50.48.5,

492 ὅταν οὖν ἀκριβῶς ἰδῇς τὴν θέσιν ἣς ἐγχειρήσεις ἐκκόψαι πλευρᾶς, τέμνε κατ' αὐτῆς, ἐν ᾧ φωνεῖ χρόνῳ τὸ ζῶον, ἅμα τῷ δέρματι πᾶν ὅσον ὑποπίπτει σαρκῶδες αὐτῷ τῷ τῆς πλευρᾶς σώματι, χρώμενος ἐπικόπῳ, καλέσαι γὰρ οὕτως οὐδὲν χειρόν ἐστιν ὁμοίως τοῖς ἀνατομικοῖς τε καὶ χειρουργοῖς, τὸ στήριγμα τῶν ὑποβεβλημένων τῇ τομῇ σωμαίων.

493 Sometimes κατ' ἐπικόπου means no more than 'directly', e.g., when Paul cuts down *directly* on blood vessels in operating for cirsocele (6.64.2), or Oribasius on scrofulous growths (*Coll. Med.* 45.17.5).

494 ὁ μὲν οὖν Λεωνίδης ὕπτιον ἀνακλίνας τὸν ἄνθρωπον σμιλῇ κατ' ἐπικόπου σανιδίου τινὸς ἢ σκληροῦ δέρματος τὸ περιττόν ἐξέτεμνε...

50.49.1). The same authority also deploys a blunt hook as an undersupport in treating varices (*Coll. Med.* 45.18.25) and, less dramatically, for sawing to remove a finger ring (*Coll. Med.* 47.17.5). Finally, in the operation for bladder stone, the stone itself becomes an *epikopon* for the tissues being incised (Pseudo-Galen, *Intro or Physician* 14.787K; Paul 6.60.2 & 4).

In sum the Greco-Roman surgeon simply used anything appropriate as a block/support. This explains why no recognizable block occurs in preserved instrumentaria. Either blocks were not items sufficiently esteemed to be regularly included in the surgical tool kit; or if they were included, being of perishable materials they do not survive.

Curette

The Greeks applied the name ξυστήρ/ξυστήριον and περιξυστήρ (*xuster/perixuster*) to an instrument suitable for scraping away hard substances, mainly bone.⁴⁹⁵ *Xuster* occurs on *Lists*; περιξύστης and ἀ<πο>ξυστήρ may also have occurred there.⁴⁹⁶ Writers in Latin prefer the term they use for chisel: *scalper/scalprum*.⁴⁹⁷ *Xuster* and *scalprum* in this sense are sometimes taken to mean the modern raspatory, but no such tool has yet surfaced in surviving instrumentaria (see below *File* and [*Raspatory*]).

First to second century instrumentaria from Italy (Fig. 3, bottom row, below forceps), Bingen, Colophon (Fig. 48a–b), and Melos contain spoon-like tools with serrated or sharp-rimmed bowls that qualify as attractive candidates, since they look to be especially suited for bone work.⁴⁹⁸ Along with these spoons any instrument featuring a roughened surface or a sharp edge would probably do. Oribasius seems so to indicate when he recommends promoting growth of flesh after head trauma by first scraping to the diploe “with an ordinary/common scraping tool” (διὰ κοινού ξυστήρος; *Coll. Med.* 46.9.5). Paul too intimates different possibilities when he employs as a tooth scaler to remove

495 περιξυστήρ occurs only once (Oribasius, *Coll. Med.* 46.11.29) before it pops up on *Lists*: Schoene (1903) 283, 284; Bliquez (1984) 201; Fischer (1987) 35(11), 36(21). The name ξυστήρ also was applied to eye salves (Aëtius 7.114.13–18).

496 Schoene (1903) 282; Bliquez (1984) 195.

497 Though *xister* occurs transliterated in the veterinary *Mulomedicina Chironis* (86 & 691: scraping boney growths under eye and over hip). At 8.4.6 when Celsus seeks to determine if the skull is fractured and scrapes ink stained skull with a *scalprum*, he must mean a scraping tool because he is here following the Hippocratics who employ a *xuster* for this purpose (*On Head Wounds* 14.2, 4, 6, 7 Hanson).

498 Künzl (1983a) 41(5), 82(14); Caton (1914) 117 (VIII & Pl. XI, 24). One notes that the Colophon specimen mounts both a serrated and a sharp edged spoon. Also to be considered are two spoon probes in Mainz featuring burred interior surfaces Künzl (1983a) 47(13 & 14).

tarter “the bowl of a spoon-probe, a small *xuster* or a file” (τῷ καθαίσκει τῆς μήλης ἢ ξυστηρίῳ ἢ τῷ ῥιναρίῳ διακαθάρωμεν; 6.28.1).⁴⁹⁹ To these tools we may add the curved serrated plates that we find on the ends of bone levers (see below).⁵⁰⁰

In Paul’s small dental scaler we may have a more specialized tool. It must be from this operation that the name ὀδοντοξέστης emerges in Pollux (2.96) as well as ὀδοντοξυστήρ on *Lists*.⁵⁰¹ We should also include here Scribonius Largus’ treatment for toothache (*dentium dolor*).⁵⁰² Rather than extract a tooth entirely, he recommends cutting out the decayed part with a *scalprum medicinale* so that the sound part can continue in use. Scribonius’ terminology seems to reflect a tool especially designed for physicians. On the other hand, his language (*excidendum scalpro medicinali, qua cavatus est* . . . “it should be hewed/cut out, where it is decayed”) may be more in tune with a chisel than a scraper.

In addition to Scribonius’ and Paul’s use of a *xuster* for dental work we find Galen describing its deployment in simple skull fracture extending only to the diploe (*Meth. Healing* 10.445–446K = J-H 2.214–215, 218–219, copied by Oribasius, *Coll. Med.* 46.21.11 & 15). Celsus follows the Hippocratics in distinguishing sutures from fractures of the skull by applying a *scalprum* to scrape away previously applied ink (8.4.6: *scalpro id deradendum*). And both he and Oribasius underline its utility in scraping smooth boney surfaces, the former in cases of fracture (8.10.7G: *scalpro levandum*), the latter after the application of chisel and trepan for removal of superfluous osteal growth (*Coll. Med.* 46.29.9 [Heliodorus] or digits (Oribasius, *Coll. Med.* 47.15.5). For leveling holes created in the skull by trepanning Oribasius applies the *perixuster* (*Coll. Med.* 46.11.29). How it differed from the common model is unclear.

From the entries in Galen we learn that, like the gouge, curettes ranged from thicker and heavier duty (τῷ πλατυτέρῳ) models to narrower types (στενωτέρῳ).

For a scraper for nasal polyp (*polupoxustes*) see Polyp Knife under Cutting/Puncturing Instruments.

For a curette for the eyelid see s.v. under Probes.

499 In a dialogue of that name Lucian has *Lexiphanes* shave his head with an ὀδοντωτῇ ξύστρεα as a conceit: Loeb edition (ed. Harmon), vol. 5, 5.13 and scholion ad loc.

500 Jackson (2008b) 196, Fig. 4.4.2, no. 1 shows a splendid iron example of a curette combined with an elevator.

501 Schoene (1903) 282; Bliquez (1984) 201; Fischer (1987) 37(33).

502 *Comp.* 53; reproduced by Marcellus Empiricus, *De Med.* 12.1.

File and [Raspatory]

The surgical file was called in Greek *ρίνη/rhine* (with diminutives *ρίνᾶριον*, *ρίνιον*) and in Latin *lima*. It was obviously a scraping instrument.⁵⁰³

Several authorities refer to the file for the leveling of large or broken teeth. They include Heracleides and Asclepiades (as preserved in Galen, *Cmpds. by Place* 12.848, 871, & 872K; copied by Aëtius 8.32), Alexander of Aphrodisias, *Prob.* 1.Pr. 38, and Paul 6.28.1. Oribasius also describes its use in leveling bone in the excision of a rib (*Coll. Med.* 44.8.8)⁵⁰⁴ and in filing through an impacted finger ring (*Coll. Med.* 47.17.4). In the latter case he qualifies the instrument with the adjective “knife-like” (*μαχαίροειδὲς ῥίνη*). In Aëtius’ account we find the added detail that the file be “dull, puren-like and quite smooth at the point.”⁵⁰⁵ Otherwise, there is no information as to appearance except that the preference for diminutive forms indicates that the surgical file was small. As to material, Heracleides or Asclepiades once creates a file of iron and Alexander of Aphrodisias implies that iron was usual.⁵⁰⁶ Until the recent excavation of the Domus ‘del chirurgo’ in Rimini it was difficult to authenticate a surgical file among surviving tools.⁵⁰⁷ Either one assumed that files, if fine and of iron, did not survive, or that the term file may have been applied to other instruments with rough surfaces which do come down to us, such as bone levers with their serrated termini. Rimini, however, has undoubtedly provided, among its many tools for bone surgery, the genuine article in the form of a finely striated iron specimen with a ring for attaching its now missing handle (Fig. 45, left).⁵⁰⁸

503 Since the file is mentioned often enough, one expects it to appear on *Lists*. If so, it may be hidden in the entry *ρίνοτορίνιον /rinotorine* which may be an erroneous compounding of *ρίνη* and *τὸ ῥίνιον*: see Schoene (1903) 283 and Bliquez (1983) 197. Fischer (1987) 36(32) sees in *ρίνοτορίνιον/rinotorine* the lancet-like *στορόνη* for nasal use mentioned by Aretaeus (*Care Chron. Diseases* 1.2.9).

504 Celsus too may be employing a file at 8.10.7F–G. When a fragment of fractured bone projects, among other remedies, ... <si> *longius est, praecidendum; si breuius, limandum et utrumque scalpro* l<eu>andum; tum ipsum recondendum est. *Limandum* suggests use of a *lima*, i.e. file, but the proximity of *scalpro* precludes certainty.

505 8.32.8: ἔστω δὲ ἡ ἀρχὴ ἀμβλεία καὶ πυρηνοειδὴς καὶ λειοτάτη.

506 In Galen, *Cmpds. by Place* 12.871K = Aëtius 8.32.8: ... σιδήριον ἐποίησα ῥίνιον ὡς ἐνεργεῖν ταχέως. Alexander of Aphrodisias, *Prob.* 1. Pr. 36–38: ἡ τίνος χάριν ἀκούοντές τινες ... ἢ τρίζοντος ἢ ῥινούμενου σιδήρου τοὺς ὁδόντας ... εὐθέως μακαρώσιν;

507 Milne’s claim that there were surgical files in the Naples Museum cannot be substantiated; see Bliquez, Jackson (1994) 2.

508 See Jackson (2003) 319 and (2005) 5.1 (2) and (2009b) 85 & 89.

In some cases an ordinary carpenter's file would do. Note that Scribonius Largus grinds up stags horn with a *lima lignaria* for a concoction against intestinal worms (*Comp.* 141).

Relevant to this section may be the enigmatic name κέστωρ/κέστρος/*cestros* which occurs only on *Lists*.⁵⁰⁹ If a surgical tool, it must be a shaftlike instrument with a roughened surface to judge by the various designations of the term in earlier sources: Pliny, *Nat. Hist.* 25.84 (a serrated tool for encaustic painting); Polybius 27.11.1 and Dionysius of Halicarnassus, *Roman Antiquities* 20.1.6 (a bolt shot from a catapult); Hesychius, *Lexicon* (A–O) kappa.2387 (roughness of the tongue).

Milne (1907) 121 believed that the ancients had developed an instrument like the rasp familiar to him consisting of “a blade of varying shape fixed at right angles to the shaft and . . . operated by pulling instead of being driven forward by striking or pushing.”⁵¹⁰ However, no such instrument has ever been recovered, as Milne himself admitted. The argument from silence becomes weightier when one considers the absence of a rasp among the many tools for bone work at Rimini, where one finds the first certain instances of the gouge and lenticular. Milne's views were founded mainly on the well known passage in the Hippocratic *On Head Wounds* (14.15, 25, 48 & 19.26Hanson) where an instrument called a ξυστήρ is used to scrape an area to which a black solution has been applied, this to determine whether a fracture or simply a suture is at issue. In fact any suitable rough surface could be used in this operation, whether a file, a curette or even a scalpel blade. Until and unless a tool resembling the modern rasp is come upon in an ancient instrumentarium, the term *xuster* in classical texts should not be interpreted as such.

Bone Lever/Elevator

The Hippocratic treatise *Fractures* (3.31.bis1–25L) contains an extensive description of levering devices called σιδήρια/*sideria*. These were applied along with extension to reduce compound fracture of the bone. In the same passage μοχλός/*mochlos*, the word used to designate the lever used by stone masons, is substituted for *sideria* and in *Joints* (4.67.7L) and *Instruments of Reduction* (4.33.14L) the diminutive μοχλίσκος/*mochliskos* occurs. That the *mochliskos* is the same device as the *siderion/mochlos* recommended in *Fractures* is clear because *Joints* refers back to *Fractures* in recommending the *mochliskos*.

Mochlos and *mochliskos* occur again in Imperial authorities to be joined by a new name, ἀναβολεύς/*anaboleus*. In his chapter on wounds, Paul directs

509 Schoene (1903) 282; Bliquez (1983) 196; Fischer (1987) 38(47).

510 Followed by Majno (1975) 169(4.26b).

the operator to pry out imbedded stones or lead missiles propelled by slings *μοχλεύσαντα δι' ἀναβολέων ἢ κυαθίσκου τραυματικῆς μὴλωτίδος...* (6.88.9). Francis Adams⁵¹¹ translated δι' ἀναβολέων (*di' anaboleon*) as “with the concave part of a specillum.” But clearly δι' ἀναβολέων refers to an elevator. For one thing Paul's use of the verb *μοχλεύω* for ‘pry out’ is the language he uses when deploying the *μοχλίσκος* (see below). For another, Oribasius, when recommending instruments for prying out *tophus* (*Coll. Med.* 45.6.2 & 9), says that this can be achieved with the bend of the *anaboleus* (τῇ... ἀναβολέως... καμπῇ), which again suits a bone lever, not a spoon-probe. Decisive is Oribasius' deployment of the *anaboleus* for prying up bits of skull in cases of fracture (*Coll. Med.* 46.11.26; 46.15.4). For these reasons I equate *mochlos/mochliskos* and *anaboleus*.

Anaboleus later finds a place on *Lists*, to be joined there (perhaps) by the compound *ὀσταναβολεύς*, which appears nowhere else, and by yet another otherwise unattested term *ἀντιβολάδιον*.⁵¹² It too must have occurred somewhere in the sense of bone lever/elevator, as its verbal form *ἀντιβόλλω* is used in connection with reduction of fracture by the Hippocratic commentator, Palladius.⁵¹³ Curiously, *mochlos/mochliskos* does not make its way onto *Lists*.

In commenting on the passage in *Fractures*, Galen explicitly associates the *mochliskos* with the type of tool used by stone workers, although he notes that the surgical type is smaller.⁵¹⁴ Like the bow drill and the surgical chisel, the bone lever demonstrates how the design of some surgical tools was adapted from tools long in use in other trades, such as carpentry and stone cutting. Galen stresses the need to have a number of elevators available, each differing in length and in the width and thickness of its end.⁵¹⁵

Of later authorities Paul offers the most extensive information. His section on compound fractures provides additional details about the shape and

⁵¹¹ (1847) vol. 3, 422.

⁵¹² Schoene (1903) 281, 284; Bliquez (1984) 195, 197; Fischer (1987) 36(28). The latter makes a case for *ostanaboleos* being a corruption for *ὀσταναλαβεύς* 35(18).

⁵¹³ *Scholia in Hippocratis de Fracturis*, ed. D. Irmer, Palladius. *Kommentar zu Hippokrates 'De Fracturis' und seine Parallelversion unter dem Namen des Stephanus von Alexandria* [*Hamburger philologische Studien* 45. Hamburg: Buske, 1977]: 16–88.

⁵¹⁴ *Comm. Hipp. Fractures* 18b.592K: *πρόδηλον ὅτι κατὰ τὸ σχῆμα παραπλήσια κατασκευάζει* (sc. ‘Hippocrates’) *σιδηρία τοῖς τῶν λατύπων, οὐ κατὰ τὸ μέγεθος οἷς γὰρ ἐπὶ τῶν ὀστέων χρώμεθα σιδηρίοις εἰς τὸ μοχλεύοντες αὐτὰ κατατάξαι τηλικαῦτά ἐστι τὸ μέγεθος, ἡλίκαι καὶ πρὸς τὴν τῶν ὀδόντων μοχλίαν ὕφ' ὧμῶν παρεσκευάσται.*

⁵¹⁵ *Comm. Hipp. Fractures* 18b.592K: *πλείω δὲ εἶναι χρή τὰ περὶ τῶν ὀστέων μοχλίαν παρεσκευασμένα διαφέροντα ἀλλήλων μεγέθει τε καὶ λεπτότητι καὶ μικρότητι τῇ κατὰ τὸ πέρασ αὐτῶν, ἔνθα μάλιστα τὸ ἔργον αὐτῶν ἐστίν.*

application of the *mochliskos* (6.107.2). Like Hippocrates he says that it should be of iron and thick enough so as not to bend. It should be seven or eight finger-breadths in length and its end should be sharp, wide, and moderately curved. In reducing a fracture, its sharp end should engage the protruding bone while pressure is applied at the other end of the instrument along with extension to re-engage the extremities of the fracture.⁵¹⁶ Paul also finds the *mochliskos* useful in dealing with dislocated joints (6.107.1.23). However, he does not go into detail there as to procedure.

Milne could cite only two surviving instruments in the Naples Museum identifiable as bone elevators (Fig. 50).⁵¹⁷ These are all of copper alloy and consist of a handle having at each end an arched plate, smooth on the outside and roughened on the inside. Since Milne's time over twenty other levers, have found their way into the scholarly literature.⁵¹⁸ These date from the first to the fourth centuries CE. There is one, perhaps two earlier examples, seen as prototypes. These were found at Kalkreise and Haltern respectively and have been connected with the sensational massacre of the legions under Quinctilius Varus in 9 CE.⁵¹⁹

Some elevators are entirely of copper alloy, some entirely of iron; but many are composite instruments, featuring handles of copper and therapeutic ends of iron/steel (Pompeii, Fig. 51; Bingen, Fig. 52.10–13; Rimini Fig. 49.18). Where therapeutic ends are well preserved we find that they assume various shapes, as the literary sources say they should: some broad, some narrow, some pointed, some squarish, splayed or shaped like a kite, etc. In many cases (Bingen, Nea

516 (If there is no inflammation, when bones project...) ἀρμόζομεν δὲ αὐτὰ τῷ λεγομένῳ μοχλίσκῳ· σιδηροῦν δὲ τοῦτό ἐστιν ὄργανον μῆκος μὲν ἔχον ἄχρις ἑπτὰ ἢ ὀκτὼ δακτύλων, πᾶχος δὲ σύμμετρον, ὥστε μὴ ἐπικάμπτεσθαι ἐν τῇ μοχλεύσει, ὁξὺ κατὰ τὸ ἄκρον καὶ πλατὺ καὶ μετρίως ἐπικαμπές· οὐτινος τὸ ὁξὺ πέρας ὑποβάλλοντες τῇ ἐπικειμένῃ τοῦ ὀστοῦ ὑπεροχῇ κατὰ τὸ ἕτερον ἀντιβαίνοντες ἅμα καὶ μετρίως κατατάσσεως τοῦ κώλου γινομένης κατ' ἀλλήλων φέρομεν τὰ τοῦ κατάγματος πέρατα.

517 Bliquez, Jackson (1994) 131(91 and 92).

518 There are in all three and possibly four in the Naples Museum and one in the Antiquarium at Pompeii (Bliquez, Jackson [1994] 43 and 131 nos. 90–93, 206 A19). Five occur at Bingen (Como [1925] 155 and Abb. 2, 10–13, 18), five at Nea Paphos (Michaelides [1984] 327), three at Aschersleben (Grimm [1936] 104–109), two at Merida (Künzl [1983a] 102) and nine at Rimini (Jackson [2005] 110–111; [2009b] 83–4, 88). Specimens have been recovered singly at Nijmegen, Wehringen, Luzzi, Colophon, Quarante and Alliano; see Künzl (1983a) 93, 107, 121; Caton (1914) 115 and Pl x; M. Feugère (1985) 44; and Baykan (2012) 154(335).

519 See Künzl (1991b) 195–196, (1996) 2451, 2584(5) and (2002a) 30. I am less certain about the purpose of the piece from Haltern. The specimen in the Bramsche-Kalkreise Museum and Park features silver inlay, nicely shown in the color illustration provided in Franzius (1993) 155(49).

Paphos, Aschersleben, Merida, Rimini and, probably, Pompeii, a number of elevators, differing in size and shape are found in the same instrumentarium, just as Hippocrates and Galen advise. In a few instances we find an elevator combined with another tool: at Aschersleben a forceps (Fig. 38.2), and at Rimini a sturdy iron blade in the form of an ivy leaf, which Jackson compares to a 17th century instrument used to begin a trepanation (Fig. 53).⁵²⁰

In addition to reduction of fractures and the stone-like tumor called tophus, the bone elevator was used for levering out teeth.⁵²¹ Its serrated/roughened surface may also have served as file or rasp (see above ss.vv.) and perhaps even to engage and extract a bladder stone.⁵²² According to Celsus (8.10.7G) a blacksmith's tongs could also be used as a bone lever (*volSELLa, quali fabri utuntur; inicienda*), the concave side of its jaws being placed against the correctly positioned bone, which then served as a fulcrum as the convex side of the jaws pressured the protruding bone back into position.

It is noteworthy that so many of these levers survive in contrast to other instruments available for bone and skull work. The explanation surely lies in good measure in the many procedures for which the *mochliskos* was found useful.

Wedge/Stake for Reduction

Celsus (8.10.7K) describes another device for reducing fractures when a wound is involved. In the event that a limb is still too short and the bones are not in place, he directs us to insert between the fractured ends, but projecting slightly from the wound, a thin wedge (*paxillus tenuis*), very smooth, which can be driven inward daily until the limb is returned to its proper length.⁵²³

Such a wedge/stake was surely of wood and, like splints, made up on the spot to suit the immediate situation.

Periosteal Elevator for the Pericranium

To treat what was probably migraine headache, a most formidable but totally unnecessary operation was performed, the hupospathismos/ὑποσπαθισμός. Three vertical incisions were made on the forehead, one in the middle and one at each temple. The intervening flaps were then raised. Next, the blood

520 Künzl (1983a) 100–1(80.2); Jackson (2009b) 78, 88.

521 Galen, *Comm. Hipp. Fractures* 18b.592K. Pseudo-Galen, *Drugs Easily Procured*, uses the general term σιδηρός (14.430K) without further details.

522 So Künzl (1983b) 490 and Taf. 65.3.

523 *Si breui<us> adhuc membrum est et ossa loco suo non sunt, e<o> paxillus tenuis quam leuissimi generis inter ea demitti debet sic, ut capite paululum supra ulcus emineat; <i>sque cotidie plenior adigendus est, donec par id membrum alteri fiat; tum paxillus remouendus...*

vessels raised with them were severed by the cutting instrument called *skolo-pomachairion* (see under Other Cutting/Puncturing Instruments), the dull edge of which faced inward toward the bone. Pseudo-Galen (*Intro. or Physician* 14.784K = Petit 19.8) and Paul (6.6) describe the procedure, the latter in detail. To elevate the flaps, Pseudo-Galen states that a simple spatula probe could be used. But by Paul's time the elevator had a special name ὑποσπαθιστήρ. Paul maintains that the operation took its name from the instrument used; but this must be wrong if the simple spatula was used centuries earlier as indicated by Pseudo-Galen. In any case, based on its name and the fact that a spatula would do just as well, the *hupospathister* could hardly have been other than a spatula-like object.⁵²⁴ Probably it was a sturdier form of spatula, something like the double spatulae recovered at Bingen and Pompeii (Fig. 28).

Michael Psellus in the 11th century includes the *hupospathismos* in his *Poema Iatrikon*, showing the long history of the intervention.⁵²⁵

The σπαθιστήρ mentioned by Epiphanius (bishop of Alexandria in the fourth century) in connection with restoration of the foreskin appears to be another name for the *hupospathister*.⁵²⁶

Bone (Sequestrum) Forceps

(See below under Forceps)

Instrument for Freeing Gums from Teeth

Tooth extraction was an operation performed with great care by the ancients. Celsus offers a detailed account (7.12.1-F). He directs us to scrape the tooth free of the gum and shake it loose before attempting extraction with forceps or fingers.⁵²⁷ A number of authorities refer to the process of first loosening the tooth, applying for the purpose a *περιχαρακτήρ/pericharakter*, or its diminutive *περιχαρακτήριον*. This method has the advantage of allowing for extraction with fingers. Pseudo Galen and Aëtius recommend first dipping the instru-

524 Paul has recourse to a *spathion* to raise the second flap. If this is another name for the *hupospathister*, then it may have had a cutting edge, as there was a type of knife called *spathion* (see Spatula knife under Other Cutting/Puncturing Instruments).

525 Psellus, Poema 9, *De medicina*, line 1335.

526 Epiphanius Constantiensis (Cypri), *De menseribus et ponderibus*, line 437: τὸ δὲ ἔτι τούτων χαλεπώτερον, ὅτι καὶ ἀπὸ περιτομῆς ἀκρόβυστοι γίνονται, τέχνη τινὶ ἰατρικῇ διὰ τοῦ καλουμένου σπαθιστήρος τὴν τῶν μελῶν ὑποδερματίδα ὑποσπαθισθέντες, ῥαφέντες τε καὶ κολλητικοῖς περιδεθέντες ἀκροβυστίαν αὐθις αὐτοῖς ἐπιτελοῦσιν.

527 For extraction with fingers after loosening with a tooth forceps, see Aristotle, *Mechanics* 854a 30–31: ὅταν δὲ κινήσῃ (the operator), ἐξεῖλε ῥᾶον τῇ χειρὶ ἢ τῷ ὄργανῳ.

ment in a drug consisting of a thick mixture of wild colocynth and vinegar.⁵²⁸ Others who mention the *pericharakter* include Caelius Aurelianus and the Hippocratic commentaor Palladius.⁵²⁹

As to its appearance we have only the name ('scraper around') to go on, as nobody offers a description and there is no recognizable surviving specimen. A flat or curved surface would do, perhaps mounted on a handle, that could be inserted between tooth and gum and worked back and forth and around. A small stylus probably served the purpose just as well. In fact, the same section in Aëtius as attests the *pericharakter*, also recommends a stylus for tooth extraction (8.36.6 & 17).⁵³⁰ This allows for the possibility that *pericharakter* is merely another name for, e.g., a stylus when used for lifting diseased teeth.

Tubes

Linked often with bleeding, purges administered anally were a regular feature in the promotion and restoration of health. In addition to anal purges, injections through hollow tubes into the other orifices of the body are widely described in the literary sources. The orifices involved account for the proliferation of names given these tubes, as will be seen in this section.

Other kinds of tubes were employed for draining and for treating irritated or infected areas. Many tubes could be used for both injection and draining. On this account we must assume that a particular tube might change its name as it was used for a different purpose. Tubes were regularly manufactured by pounding thin sheets of metal (all survivors are of copper alloy) into the desired shape.⁵³¹ Sometimes the seam created in the process was soldered closed, as in the case of the cannulae in the Naples Museum (Fig. 60); sometimes it was left open, as in the case of the catheter from Colophon (Fig. 59a–b) and the tube in the Smithsonian (Fig. 57b).

The various kinds of tubes include:

528 Pseudo-Galen, *Drugs Easily Procured* 14.431K and Aëtius 8.36.17. The similarity of their language points to a common source.

529 Caelius Aurelianus, *Chron. Diseases* 2.4.74: *ferramento quod pericharactera vocant*; Palladius, *Comm. Hippoc. Epidemics* 6, 2.174: προσεκάλευσε γὰρ ὁ ἱατρὸς περιχαρακτῆρι τὸν ὀδόντα...

530 εἶτα διαστήσας ὥραν ἔλκυσον τοῖς δακτύλοις ἢ γραφεῖω ἀνάλαβε...καὶ ἀποβάπτων εἰς τὸ φάρμακον τὸν περιχαρακτῆρα καὶ περιχαράσσων...

531 Longfield Jones (1978) 248.

Clyster Tubes

Among the most common procedures the Greco-Roman physician might perform for a host of different conditions was administration of an anal or vaginal/uterine injection or enema/douche. The injection was generally referred to in both Greek and Latin texts as a 'clyster' (κλυστήρ/*kluster*), from the verb κλύζω: 'to wash away, drench, purge'; accordingly, the same name was given to the apparatus for its delivery. Another term for the injection and its apparatus was ἐνετήρ/*eneter*.⁵³² Lists incorporate both.⁵³³

The clyster consisted of a tube tied to a bag, the former also called in Greek *kluster* or its diminutive *klusteridion*, ἐνετήρ/*eneter*, αὐλίσκος/*auliscus*, φυσάριον/*phusarion* and in Latin, *fistula* or *tibia*.⁵³⁴ That the tube might be regarded as specifically designed for surgical purposes is shown by Alexander of Tralles who calls it αὐλίσκος ἱατρικός (*Therap.* 2.363.20). In cases involving the urinary tract a catheter tube could be used as a *kluster* (see below: Catheter). To the bladder/bag were given the names ἀσκός/ἄσκιον (Alexander of Tralles, *Therap.* 2.363.23; Aëtius 6.34.22), ἄσχωμα (Pseudo-Galen, *Intro. or Physician* 14.675K = Petit 1.2; Aëtius 11.27.29), κύστις (Galen, *Meth. Healing* 10.337K = J-H 2.48–49), φῦσα (Aëtius 11.27.29) and, in Latin, *folliculus* (Caelius Aurelianus, *Chron. Diseases* 4.3.24–26). When squeezed, the purge or douche with which the bag had been filled was injected.⁵³⁵ Oribasius (*Coll. Med.* 8.24–38), Severus Iatrosophistes (*De Clysteribus*), and Caelius Aurelianus (*Chron. Diseases* 4.3.24–35), among others, may be consulted for extensive treatment of clysters, their ingredients and application.⁵³⁶

532 Severus Iatrosophistes, περὶ ἐνετήρων ἤτοι κλυστήρων (title); Alexander of Tralles, *Therap.* 2.363.22; Cassius Felix 48.18.

533 Schoene (1903) 282, Bliquez (1984) 199–200.

534 Galen, *Meth. Healing* 10.301K = J-H 1.456–457 (ἐνιέναι τε τὸν αὐλίσκον τοῦ κλυστήρος εἰς τὴν ἔδραν); Paul 4.57.6 (διὰ κλυστηριδίου τινὸς ἰσχυρὸν ἔχοντος αὐλίσκον) and 4.57.15 (διὰ κλυστήρος πολυτρήτου); Cassius Felix 48.18 (*per enetera id est tibiam iniectoriam*); Caelius Aurelianus, *Chron. Diseases* 4.3.26 (*clysteris fistulam*). For the diminutive form *klusteridion* applied specifically to the tube: Soranus, *Gyn.* 3.41.4 Ilberg = 3.12.41 BGM (διὰ κλυστηριδίων ἢ μητρεγχύτου) & 4.7.8 Ilberg = 4.4.70 BGM (διὰ κλυστηριδίου). Oribasius (*Coll. Med.* 10.26.1) once uses the term *phusairion* to distinguish a clyster apparatus for the vagina from one employed for the uterus; see below, Uterine Syringe. *Auliscus fysarius* occurs once in Cassius Felix (19.2) as a clyster apparatus for pendigines (= abscesses, fistulous ulcers).

535 Oribasius, *Coll. Med.* 8.24.9 [Rufus] & 8.34.3.

536 The substances injected were classed in several categories: terms like δριμύς (Aëtius 11.32.22), δραστικός (Aëtius 8.57.90), πρακτικός (Aëtius 11.5.70), σφοδρός (Aëtius 12.30.9), εὔτονος (Galen, *Cmpds. by Place* 12.550K), and *acerrimus* (Caelius Aurelianus, *Acut. Diseases* 3.8.91 [Asclepiades]) indicated stronger purges. Terms like πρᾶος (Aëtius 12.1.66),

Galen, as Hippocrates, identifies the bladder as that of a swine (*Glaucōn, Meth. Healing* 11.125; *Cmpds. by Kind* 13.499–500K), Paul as that of an ox (6.59.2), and an hilarious epigram in the *Greek Anthology* as that of a goat (*Anth. Graec.* 14.55). Caelius Aurelianus tells us that the Greeks used the term ἀσπιδίσκος/*aspidiscos* ('little shield') to designate the flange at one end of the tube to secure attachment of the bladder (*Chron. Diseases* 4.3.24). A copper alloy tube in the Smithsonian Institution, Washington DC, has this feature (Fig. 57a–b).⁵³⁷ The distal opening of the tube is called by Mnesitheus τὸ τρύπημα (Oribasius, *Coll. Med.* 8.38.3–5). Fischer has argued via Festus and Hippocrates that the term εὐδίαιον in Pollux refers to the tube of a clyster equipped with a stopper at its distal/injection end.⁵³⁸ His view is supported by Paul's choice of the verb εὐδιάζω when he describes, as part of the insertion process, stopping a catheter with wool (6.59.1); see below: Catheter.

In addition to the rectum and female parts,⁵³⁹ the *kluster* was also employed for injection of oral medications and nourishment in the case of recalcitrant children (Paul 4.57.6) and of various concoctions to treat severely sore throat (Pseudo-Galen, *Drugs Easily Procured* 14.439K), chronic ulceration in the ear (Paul 3.23.4), abscess/ulceration of the bladder (Paul 3.45.7 [Archigenes]), and a subcutaneous ulcer called kolpos (Galen, *Cmpds. by Kind* 13.499; Paul 4.48.2).⁵⁴⁰ When the solution was discharged, it made a noise (*Anth. Graeca* 11.119); if one did not apply continual pressure while squeezing the bag, the injection might be expelled back into it (Oribasius, *Coll. Med.* 8.38.12 [Mnesitheus]).

We have seen an instance in which Hippocratics recommend placement of the clyster tube by a female patient (*Diseases of Women* 222). One of Aesop's fables also seems to indicate self-administration of a solution (*Fabulae* 116.1–3).

πραυντικός (Aëtius 7.24.7 = Hirschberg, Waugh pp. 30–31. Chp. 24, who read κλυστήρσιν ὑπακτικοῖς), ἀπαλός (Oribasius, *Coll. Med.* 8.24.1–3 [Rufus]), ἀπλοῦς (Aëtius 9.1.61), ἀνετικός (Aëtius 16.78.39) and *mollis* (Cassius Felix 55.5) were applied to more gentle injections. We also hear of the classifications κοινὸς κλυστήρ (ordinary clyster) and εἰδικώτερος (more specific); see Severus Iatrosophistes, *De Clyst.* 5.4 (title) & 12.20 (title). Rufus, as excerpted by Oribasius (*Coll. Med.* 8.24.1–7) lists the different ingredients for δριμύς and ἀπλοῦς. We also hear of injections for nourishment (τρόφιμοι) in the same excerpt (13) and at Oribasius, *Coll. Med.* 8.34.

537 Bliquez (1998) 89–92. Provenance of this tube is uncertain. Even if its authenticity is somewhat questionable, it is useful for purposes of illustration.

538 Fischer (1992) 142.

539 Including the parts of mares, to encourage conception: *Hippiat. Ber.* 15.8.10: αὐλίσκων μακρὸν προτιθείς.

540 I cannot entirely exclude the possibility that, in the case of injections to ear and bladder διὰ κλυστηριδίου, Paul may have in mind the ear syringe and the catheter.

With the names designating the tube or pipe of the clyster we often find a fair amount of descriptive information. Though Hippocratic models of silver are seldom mentioned in Imperial texts,⁵⁴¹ we learn (no surprise) that a tube might be made of copper alloy (Galen, *Glaucōn, Meth. Healing* 11.125K) or bone/horn (Galen, *Glaucōn, Meth. Healing*, 11.125K, *Cmpds. by Kind*, 13.499K; Cassius Felix 78.7; Oribasius, *Coll. Med.* 8.32.7, 8.34.3, *Ecl. Med.* 57.7; Aëtius 9.38.23).⁵⁴² In veterinary texts we find that even a small, waxed reed could be called into service, reminiscent of the Hippocratic practice of employing the shafts of feathers.⁵⁴³ In addition, the tube could be bored straight through (εὐθύτητος),⁵⁴⁴ meaning open at both ends,⁵⁴⁵ or not open at its injection end but perforated all around its sides with numerous small openings, rather like the Hippocratic model described in *Diseases of Women* 8.222.11–25L. Some tubes were εὐρύτερος, or wider than others (Aëtius 9.28.40, 9.32.18),⁵⁴⁶ or wide in part. Aëtius, for example, has these specifications for a tube to combat ascarides.

A tube of horn perforated on all sides has to be prepared, broad at the base, corresponding to the size of the area. When we have positioned it under (= past) the sphincter we fill (the area) with cedar oil so that the placement of the oil accords both with the open space opposite and the sides everywhere (9.38.23–25 [probably Herodotus]).⁵⁴⁷

References to multiple lateral perforations are frequent.⁵⁴⁸ According to Oribasius, clyster pipes perforated on the side were suited to patients prone to

541 I once find reference to a silver ear clyster by Cassius Felix (46.13; rejected as suitable for bladder injection for males); see below, s.v. Ear Clyster (Syringe?).

542 Galen once seems to think a horned tube does not quite fall into the category of clyster: *Cmpds. by Kind* 13.499K: ἐγγέμεν αὐτὸ δι' εὐρυτήτου κέρατος, ἐν τρόπῳ κλυστήρος...

543 ἔστω δὲ ὁ κλυστήρ ἄσκιον, καλὰμιον ἔχον ἐνδεδεμένον καὶ κεκηρωμένον... (*Hippiat. Berlin* 75.1.17); κλύζειν δὲ πτεροῦ σύριγγα προσδήσας πρὸς κύστιν ([Hippocrates] *Fistulas* 6P).

544 Galen, *Cmpds. by Kind* 13.499K; Oribasius, *Coll. Med.* 8.33.3; Paul 4.48.2 (*kolpos*).

545 Oribasius, *Ecl. Med.* 57.7 (ascarides): αὐλίσκος... πρὸς τῇ βάσει εὐθύτητος.

546 In a veterinary text we also find εὐρυχωρός: *Hippiat. Ber.* 37.2.5–6 (chordapsus) ποίει δὲ καὶ κλυστήρα... ἀναμειγνύς χρῶ μετὰ εὐρυχωροτέρου αὐλίσκου.

547 κατασκευαστέον δὲ κεράτινον αὐλίσκον πάντοθεν περιτετριπτημένον, εὐρὺν δὲ κατὰ τὴν βάσιν, τῷ μεγέθει τοῖς τόποις κατάλληλον, ὃν ἐνθέντες ὑπὸ τὸν σφιγτήρα πληροῦμεν κεδρία, ὥστε τὴν ἔνθεσιν τῆς κεδρίας καὶ κατὰ τὴν ἀντικρὺ εὐρυχωρίαν καὶ κατὰ τὰ πλάγια πάντοθεν γίνεσθαι.

548 See Oribasius, *Coll. Med.* 8.33.3 (κλυστήρα... ἐκ πλαγίων κύκλῳ πολλὰ σμικρὰ τρήματα ἔχοντα for ascarides); *Ecl. Med.*, 57.7 (διατετριμένος for ascarides); Aëtius 9.38.23 (πάντοθεν περιτετριπτημένον for ascarides); Cassius Felix 48.18 (*tibiam iniectoriam multis cavernulis*

dysentary or “with susceptible parts”, while the wide-bored models were best for injecting abundant and thicker solutions well into the bowel.⁵⁴⁹ Lubrication of the tube, if necessary, was achieved with goose or swine fat.⁵⁵⁰ In veterinary treatises we hear of waxed tubes.⁵⁵¹ And of course various lengths are discussed.⁵⁵² For children resising oral injection Paul recommends a strong/sturdy model (ἰσχυρόν: 4.57.6).

Though he only mentions a tube, which he calls *siphon*, the veterinarian Vegetius may be using a tube-bladder combination to inject medication into the nose of a beast suffering from glanders (*De Mulomedicina* 1.10.1) and into the eye of one afflicted with ‘white spot’ (*album*: *De Mulomedicina* 2.20.2).

As for survivals, in addition to the tube cited above in the Smithsonian, two tapering, hollow specimens in the Naples Museum, open at their distal and proximal ends, might do for anal injection (Fig. 1, bottom row, far left and Fig. 55). One and possibly both were found in the so-called House of the Surgeon in Pompeii.⁵⁵³ The same might apply in the case of smaller tubes in the Museum but these cannot be associated with surgical sites; we may also cite a tube of bone with one lateral perforation at its base recovered in Rome.⁵⁵⁴ For the intriguing tube from Alliano, see under *cannula* below. For uterine syringes in Naples, see the next section.

Uterine Clyster

The first detailed description of the tube used in injecting solutions into the female parts is described in the *Hippocratic Corpus* (*Diseases of Women* 8.222.11–25L). This is said to have a solid tip of silver and, after an opening

perforatam quae appellatur polytretos for dysentery); Caelius Aurelianus, *Chron. Diseases* 4.3.26 (*clysteris fistulam... quam Graeci amphitreton vocant... for coeliac disease*).

549 Oribasius, *Coll. Med.* 8.24.62: ἐπεὶ δὲ τῶν αὐλίσκων, οἱ μὲν εἰσι εὐθύτρητοι, οἱ δὲ παράτρητοι, <ἀρμόζουσιν οἱ μὲν παράτρητοι> ἐπὶ τε δυσεντερικῶν καὶ τῶν εὐπαθέστερα τὰ μέρη ἔχόντων, οἱ δ' εὐθύτρητοι ἐφ' ὧν πλείω διώσασθαι τὸ κατάκλυσμα βουλόμεθα καὶ ἐκ τῶν ἄνω τι τόπων ἀγαγεῖν καὶ ἐφ' ὧν παχύτερά ἐστι τὰ ἐνιέμενα.

550 Aëtius 9.42.142–144: διαχρίεσθω ὁ δακτύλιος... χήνειον στέαρ ἢ ὕειον· καὶ αὐλίσκος δὲ καταχρισθεὶς εἰς πάχος καθεθήσεται.

551 *Hippiat. Berl.* 75.1.17: καλάμιον... κεκηρωμένον...

552 τὸ κέρας τοῦ κλυστήρος ὡς οἶόν τε βράχιστον, ἵνα τοῦ κλύσματος μηδὲν ὑπερήχη προσωτέρω τῶν δεομένων μερῶν (Oribasius, *Coll. Med.* 8.32.7); μήχιστον [τὸν] τοῦ κλυστήρος εἶναι τὸ κέρας (Oribasius, *Coll. Med.* 8.34. 3); αὐλίσκον μακρὸν προστιθεὶς (*Hippiat. Ber.* 15.8.10); λαβὲ κλυστήρα τῶν μεγάλων (*Hippiat. Cantabrig.* 34.3.2).

553 Bliquez, Jackson (1994) 167(233–234).

554 Bliquez, Jackson (1994) 169(238–39). The Roman tube appeared in *Notizie degli scavi di Antichità* = *Atti della R. Accademia Nazionale dei Lincei* (1901) 143.

nearby, a series of openings at intervals along the side of the tube. The multiple perforations appear to have remained a standard feature of the design as Paul, in referring to this type of clyster as μητρεγχύτης (*metrenchutes*) or uterine syringe, offers a similar description.⁵⁵⁵ The name μητρεγχύτης first occurs in Soranus, recurs frequently in Imperial and Early Byzantine authorities, and is found on *Lists*.⁵⁵⁶ It appears, therefore, that *metrenchutes* became the standard term during or before the first century. In the literary sources it is specifically associated with injection into the female parts, though Paul (4.57.15) cites it once for treatment of ascarides. The female conditions include: uterine hemorrhage and 'flux' (Soranus, *Gyn.* 3.41.4 Ilberg = 3.12.41 BGM & 3.44.3 Ilberg = 3.13.56 BGM; Oribasius, *Ecl. Med.* 148.2; Paul 3.63.2.9), menorrhagia (Oribasius, *Ecl. Med.* 147.14; Paul 3.62.3.6 and 10), uterine prolapse (Cassius Felix 78.7) and, in Aëtius, irregular menstruation (16.61.41), hysterical suffocation (16.67.107), uterine inflation (16.73.31), uterine edema (16.74.21) and watery genital discharge (16.104.3).

While Galen and the authorities just cited view the *metrenchutes* as an instrument designed for uterine injections,⁵⁵⁷ they also allow for the regular *kluster* or *klusteridion*.⁵⁵⁸ Curiously, Antyllus administers solutions to the uterus with the *metrenchutes* but prefers a *phusarion* for vaginal injections.⁵⁵⁹ The latter may have featured a shorter tube without lateral perforation.

Several tubes of copper alloy in the Naples Museum are mounted on cup-like cylinders and feature a series of holes running the lengths of their shafts (Fig. 1, bottom row, middle, above awl and Fig. 56). These might have served for anal injection but, as they answer perfectly to the injection tube recommended in Hippocrates and Paul and, as at least one of them (and very possibly both) were recovered along with gynecological instruments in Pompeii, we are justified in thinking of them as representing the *metrenchutes*.⁵⁶⁰ A 'canula di osso' recovered at Rome bears a strong resemblance to the tubes in Naples.⁵⁶¹ However it has only one opening on the side at its base. A tapering tube with numerous lateral perforations and a flanged upper rim (see above,

555 και τῇ κεδρέῃ δὲ αὐτοὺς (ascarides) ἐνετέον διὰ κλυστήρος πολυτρήτου, οἷοίπερ εἰσιν οἱ μητρεγχύται προσαγορευόμενοι... (4.57.15).

556 Schoene (1903) 282; Bliquez (1984) 201; Fischer (1987) 37–8(45).

557 E.g., *Meth. Healing* 10.328 & 10.358K = J-H 2.34–35 & 2.80–81; *Cmpds. by Place* 13.316K.

558 E.g., Oribasius, *Ecl. Med.* 147.14 (διὰ κλυστηριδίου ἢ μητρεγχύτου) & 148.2 (διὰ μητρεγχύτου ἢ κλυστήρος).

559 Excerpted by Oribasius, *Coll. Med.* 10.26.1: ἐγχυματισμοῖς δὲ χρώμεθα ἰδίως ἐφ' ὑστέρας διὰ μητρεγχύτου· ὁ δὲ πρὸ αὐτῆς κόλπος διὰ φουσαρίου.

560 Bliquez, Jackson (1994) 11–13, 167(231–232).

561 *Notizie degli scavi di Antichità* = *Atti della R. Accademia Nazionale dei Lincei* (1901) 143. Cassius Felix (78.7) prescribes a model of horn: *encolpizabis per corneum metrenchyten*...

Clyster Tubes), is in the Smithsonian Institution, Washington DC. It is said to come from Jerusalem.

Nasal Clyster

We read here and there of substances used as nasal injections called ῥινέγγυτα⁵⁶² and occasionally of a syringe (ῥινεγγύτης/*rhinenchytes*) intended to deliver them.⁵⁶³ Of the authors who mention this term only Scribonius Largus gives any detail and that is sparse indeed. He calls the *rhinenchytes* a ‘horn’, which leads one to think he means a tube of horn/bone to which a bag was attached, in other words a regular clyster device, though one of small size.⁵⁶⁴ One would be inclined to let the matter rest there were it not for an *aulos*/αὐλός, or tube, described by Aretaeus in the 2nd century CE for a nasal injection of euphorbium and other ingredients to evacuate phlegm in cases of chronic headache (kephalaia).

And the injection is made through a nasal tube. It is of twin elements uniting in one stem, so as to inject both nostrils simultaneously. The distention of each nostril individually would otherwise be unbearable.⁵⁶⁵

Aretaeus does not say whether his *aulos* delivers its injection by means of a bag or is piston driven like the pus extractor and (possibly) the ear syringe (see next). Although he does not apply the name *rhinenchutes* to his *aulos*, it may also have borne this name and, if so, have been the same as the tube mentioned without essential detail by Scribonius and others. If not, Aretaeus offers the sole surviving description of a distinct and very specialized instrument.⁵⁶⁶

There is no recognizable survival of Aretaeus’ *aulos* and the name *rhinenchutes* does not occur on *Lists*.

562 E.g., Galen, *Cmpds. by Place* 12.582K [Archigenes], Oribasius, *Ecl. Med.* 73.7 (for facial paralysis on one side: διὰ ῥινεγγύτου καθάρσεις, copied by Paul, 3.18.5).

563 Aëtius 6.52.10 (sternutatory διὰ ῥινεγγύτου ἐγγυθείς); Scribonius Largus, *Comp.* 7; Caelius Aurelianus, *Chron. Diseases* 2.4.82 (*nari ederae sucum infundentes . . . , ex ferraumento quod rinenchyton vocant*). See also *Chron. Diseases* 3.2.42.

564 *Comp.* 7: *per nares ergo purgatur caput his rebus infusus per cornu quod rhinenchytes vocatur*.

565 ἐγγεῖται δὲ διὰ τοῦ ῥινός γ’ αὐλοῦ. διδυμοὶ δὲ οἷδε ξυμφυέες ἀπὸ μιῆς ἐκροῆς ὡς ἐσάπαξ ἀμφοτέροισι ἐγγεῖν· οὐ γὰρ ἀνάσχετον ἢ διαστάσεις ἐκατέρου μυκτήρος ἰδιῇ καὶ ἰδιῇ (*Care Chron. Diseases* 1.2.6).

566 If Aretaeus was a first not a second century figure, as some have thought, Milne could be right in thinking the name *rhinenchutes* was not yet in vogue in his time; for Aretaeus’ dates see Alain Touwaide’s entry in Keyser and Irby-Massie (2008) 129.

Ear Clyster/Syringe

Celsus is particularly partial to an injection apparatus that he calls *oricularius clyster*. He recommends its use in washing out of the ear accumulations of wax and intruding bodies. In addition, he employs it in irrigating, with various solutions, fistulas, the foreskin in cases of phimosis, penile carbuncle, and even the bladder through the wound created in lithotomy operations.⁵⁶⁷

In Greek sources the instrument goes by a variety of names including: ὠτικὸς κλυστήρ, ὠτικὸς ἐγχυτήρ, ὠτικὸν κλυστηρίδιον, and ὠτεγχύτης.⁵⁶⁸ The latter name makes its way onto *Lists*.⁵⁶⁹ Cassius Felix twice (28.8; 46.13) mentions an *auliscus oticus* for ear and bladder issues; this he had to have seen somewhere in Greek authorities. Caelius Aurelianus uses a hybrid Greco-Latin term *clyster auricularis* (*Chron. Diseases* 2.1.23). No such name(s) occurs in the *Hippocratic Corpus*. This points to the development of this irrigator, sometime in the Hellenistic period.

Aside from the numerous references to it in Celsus, the instrument is mentioned by subsequent authorities as useful for preparing and making injections in the following similar and other situations:

Earache: [Dioscorides] (*Euporista or Simples* 1.56.1); Galen (*Cmpds. by Place* 12.603K [copied by Alexander of Tralles, *Therap.* 2.83.1], *Comm. Hipp. Epid.* 6, 17b 267K as ed. by Wenkebach p. 282); Oribasius (*Eunap.*, 4.36.9); Cassius Felix 28.8.

Strengthening hearing: Galen (*Maint. Health* 6.439K).

Removal of a dried plug used to arrest nosebleed: Galen (*Cmpds. by Place* 12.692K [Heracleides of Tarentum]).

Enema for an infant: Soranus (*Gyn.* 2.56.1 Ilberg = 2.24.4 BGM).

Irrigating ulcerated bladder: Paul (6.59.2).

567 Celsus 5.28.12M (fistula); 6.7.3B, 6.7.9B (ear); 6.18.2 (foreskin); 6.18.5 (carbuncle on penis); 7.26.5E, 7.27.6 (bladder). I find only one instance in Celsus where *clyster* is not qualified by *oricularius*: 7.27.3 ('cancer' as a sequella to lithotomy). However the text contains a lacuna just before *clystere*. I would like to restore *oriculario* in this space: (1) because there have been two references to *clyster oricularius* immediately before in the section on lithotomy and (2) because this would be the sole occurrence of *clyster* not modified by *oricularius*.

568 ὠτικὸς κλυστήρ (Galen, *Cmpds. by Place* 12.692K [Heracleides of Tarentum]); ὠτικὸς ἐγχυτήρ (Oribasius, *Eunap.* 4.36.9), ὠτικὸν κλυστηρίδιον (Aëtius 16.89.33), and ὠτεγχύτης (Galen, *Cmpds. by Place* 12.603K).

569 Schoene (1903) 284; Bliquez (1984) 204; Fischer (1987) 38(52).

Paralysis of intestines and bladder: Caelius Aurelianus (*Chron. Diseases* 2.1.23).

Fistula: Oribasius (*Coll. Med.* 8.24.65).

Kolpos or fistulous ulcer: Oribasius (*Coll. Med.* 8.24.65).

Abscesses: Oribasius (*Coll. Med.* 8.24.65, mesopleuritic); Aëtius (16.89.33, vaginal); Paul (6.73.2, uterine).

As to the appearance of the instrument, Galen classifies it along with the clyster, catheter and *metrenchutes* as a surgical tube (*Meth. Healing* 10.358K = J-H 2.80–81). Caelius Aurelianus relates that it is formed of a thin pipe (*Chron. Diseases* 2.1.23; *tenuē ex aulisco formatum*) capable of being inserted into a catheter for irrigation of the bladder. This means that at least sometimes the tube or pipe of the instrument had to be fine enough and long enough to be introduced well into the urethra. So one concludes from this passage and Paul (6.59.2).

Milne believed that the pipe of Celsus' *oricularius clyster* differed from an ordinary clyster pipe in that the solution passing through it was expelled, not by squeezing a bag, but by depressing a plunger; in other words, the instrument was a syringe. His assement was based: 1) on the uses attributed to it by Celsus, 2) on Paul's account of ulcerated bladder (6.59.2), where he contrasts the ὠτικὸς κλυστήρ with a bladder attached to a catheter, as if the two injectors were distinct, and 3) on Albucasis who clearly describes and illustrates a syringe (198–199 Spink and Lewis). Albucasis' account is relevant because it looks to be based (if indirectly) on Galen and perhaps [Dioscorides], who, like him, tell us that the solution to be injected might first be heated "in the *otenchutes* (ἐν ὠτεγχύτῃ) over a lamp or a wax torch."⁵⁷⁰ Positioning a bag of organic matter over a flame would be a much clumsier operation than heating liquid in a metal tube kept in place by a plunger.

⁵⁷⁰ [Dioscorides], *Euporista or Simples* 1.56.1: ἐγγέας εἰς ὄξος ἔλαιον κεχλιασμένον ἐν ὠτεγχύτῃ . . . ; Galen, *Cmpds. by Place* 12.603K: ἐμβάλλω τε τὸ φάρμακον ὡδὶ πως ἐτοιμασθὲν, κεχλιασμένον ἐν ὠτεγχύτῃ . . . , *Comm. Hipp. Epid.* 6, 17b 267K as ed. by Wenkebach p. 282: ἔστω δὲ δηλονότι τὸ φάρμακον ἐν ὠτε<γ>χύτῃ <θερμαινόμενον> ὑπὸ λυχνιαίας φλογός ἢ ὑπὸ τοῦ καλουμένου κηρίωνος. I say 'indirectly' because there is no evidence that Albucasis knew any Greek. In the main his surgery seems based on an Arabic rendering of Paul. See Pormann (2004), esp. 300–302 and 308.

We can also point to a relevant archaeological survival unknown to Milne: a plunger driven syringe recovered at Nea Paphos, Cyprus in 1983 (Fig. 58a–b).⁵⁷¹ This discovery firmly establishes the existence of syringes under the Roman Empire. Because it fits comfortably with descriptions of the *puoulkos* or pus extractor, it is treated immediately below. However, the name ear syringe could easily have been applied to the Nea Paphos instrument, depending on the operation in which the physician was engaged.⁵⁷²

Unfortunately, Cassius Felix, whom Milne did not consider, muddies the water considerably. In the event of a bladder infection/ulceration he makes an injection (46.13 Fr):

... *per auliscum oticum aeneum lenem, et non osseum ne frangatur, aut certe argenteum fabricatum et vesicae porcinae alligatum* ...

... with an ear tube, smooth, made of copper alloy (and not bone, so as to avoid breakage) or of silver and attached to a swine's bladder ...

For Cassius Felix, the *oticus auliscus* was clearly not a piston driven syringe. Unless he was mistaken, we are left with two possibilities: 1) that the *oticus*

571 Michaelides (1984) 318(20) for tube, 320(33) for fragment of plunger.

572 A ringed tube from Herculaneum now in the Naples Museum has also been cited as a possible survival. This consists of a T-shaped plunger fitting into a tube featuring a ring at its apex and two openings at its base, one lateral, one at the tip (Fig. 1, middle row, 3rd from left; Fig. 60, left). On the whole though it is preferable to see in this instrument a cannula/trocar (see below). For the provenience of this piece see Bliquez, Jackson (1994) 20–24. For its identification as an ear syringe see O.A. Bayardi (1755) 363 ('Una siringa, o sia clistere auriculario') and 'Tenon', as cited in Védrenes (1876) Pl. IX, 7 ('une clyster auriculaire'). A similar device (Fig. 34) is in the Institut für Geschichte der Medizin und der Naturwissenschaften of the Friedrich Schiller Universität, Jena. There is some question whether it is ancient; see Künzl (1991a) 48(33) and (1991aa) 1 533(33). Also to be noted are a number of simple tapering tubes of copper alloy that have been found in surgical contexts. They are usually thought of as drainage tubes, clyster tubes or, mistakenly, as catheters. However, if the ear irrigator was sometimes a syringe, those with closed seams could have served as crude injection tubes by inserting into them a plunger. A plunger could be fashioned on the spot from, e.g., a shaft of wood wound with a rag. Note that in the tenth century Albucasis (Spink and Lewis 198) proposes wrapping a bit of wool around an obturator or probe to make it fit tightly against the sides of the tube in his version of ear syringe. The wool is intended to function as a flexible gasket, preventing the injection from partially slipping back and being lost and the remaining portion of the injection being thereby expelled with less force. In some instances, therefore, an ear syringe may have been produced by improvisation.

auliscus and other kindred names merely represented a variant of the regular clyster; or 2) that there were two versions of this instrument, one a bladder and tube and one a piston driven syringe. It is here assumed there were two versions, which might explain why this particular injector went by so many names.

Puoulkos or Pus Extractor

Heron of Alexandria, writing in the first century, proposes in his *Pneumatica* (2.18) a detailed design for a syringe that he calls *πυουλκός* (*puoulkos*) or 'pus extractor.' It consists of a slender little injection pipe attached to a reservoir tube equipped with a close fitting cylindrical plunger. As envisaged by Heron, the *puoulkos* performed two functions: it could make injections when the plunger was pushed forward and it could extract fluid like pus when the plunger was withdrawn. Unlike Heron's vacuum cupping vessel, which seems only to have existed on paper, the *puoulkos* is cited by a number of authorities as actually employed.

The best source in this regard is Galen. He advises Glaucon to inject a burnt papyrus medicine into a subcutaneous ulcer, or *kolpos*, with a wide bore *puoulkos*. But he warns that, if liquified salves are to be injected, they do not pass out through the *puoulkos*. In those cases, he says, it is best to attempt the injection with a straight tube attached to a swine's bladder (*Glaucon, Meth. Healing* 11.125K; copied by Oribasius, *Coll. Med.* 44.12.2–3).⁵⁷³ In a similar passage on *kolpos* Galen again recommends the tube/bladder combination and again allows for injection with a *puoulkos*, stressing that those with broader bores are most useful (*Cmpds. by Kind* 13.500K). By contrasting the *puoulkos* with tube and bladder apparatuses, Galen offers indirect evidence that the former was a piston driven syringe, as described by Heron. A passage in *Method of Healing* would seem to put the matter beyond doubt (10.340K = H.-J. 2.52–53). In dealing with an ulcer that penetrates out through the thoracic wall, affecting lung, rib, and pleura, Galen says it is his habit to inject hydromel through the opening and then to remove superfluous hydromel with a *puoulkos* before administering medications.⁵⁷⁴ Only a tube with a piston plunger could create the vacuum needed to effect extraction of fluid.

573 βέλτιον μὲν αὐλίσκον εὐθύτρητον ἢ ἐκ χαλκοῦ πεποιημένον ἢ ἐκ κέρατος ἡτοιμάσθαι σοι μὴ παρόντος δ' ἐκεῖνου, τῶν καλουμένων πυουλκῶν ὅστις ἂν εὐρύτατον ἔχοι τρήμα—ὅσα δ' ἐμπλαστὰ φάρμακα τήκοντες ῥοδίνῃ τοῖς τοιούτοις ἐνίεμεν, οὐ διεξέρχεται τὸν πυουλκόν· ἀλλ' ἐπὶ τούτων κύστιν προσήκει λαβόντα χοιρείαν, προστιθέναι τὸν εὐθύτρητον αὐλίσκον.

574 εἰώθαμεν οὖν ἐν τῇ θεραπείᾳ μελίκρατον ἐκχέοντες διὰ τοῦ ἔλκους...καὶ ποτε καὶ πυουλκῶ κομίζεσθαι τὸ ὑπολειπόμενον ἔνδον τοῦ μελικράτου.

From Galen then, we gather that the *puoulkos* actually existed and was used, that it was constructed along the lines of Heron's plan, that is, like the modern syringe, and that its injection pipe came in different sizes.

In addition to the passage on kolpos that he copies from Galen, Oribasius injects medicaments through the *puoulkos* for relief of rectal inflammation (*Ecl. Med.* 82.1) and genital ulceration (*Ecl. Med.* 83.4). Paul follows him (3.59.4; 7.17.36).⁵⁷⁵

A passage in the *Euporista or Simples*, a work attributed to Dioscorides (fl. 60–78), refers to the *puoulkos* in treatment of rectal ulceration (1.214.1). Unfortunately, the authorship of Dioscorides can be questioned and the treatise may be of later date.⁵⁷⁶ Galen therefore provides the earliest certain testimonia to the existence of the *puoulkos* and its use by physicians. The name makes its way through to *Lists*.⁵⁷⁷

Heron's *puoulkos* was developed in an era of interest in piston driven devices.⁵⁷⁸ However, where medicine specifically is concerned, he may have been inspired by a plunger driven ear syringe (see above) or by instruments like the trocar or cannula.⁵⁷⁹ Observing these, he may simply have developed a more sophisticated device by, say, replacing, a plunger mechanism consisting of a shaft and a tuft of wool, like the one shown for the ear syringe in the manuscripts of Albucasis, with his cylindrical tube. If properly engineered, the plunger tube fit flush against the interior surface of the reservoir tube of the syringe and engaged it much more securely than the traditional wool plug. This innovation enabled such a syringe not only to expel its injection with greater force but also to create a vacuum when the plunger was withdrawn from the base of the tube. Because of its design, Heron's syringe could suck up fluids, even thick ones, in addition to expelling liquid medicaments with considerable force. Since Heron had in mind pus as the thick fluid his syringe might be

575 In the case of genital ulceration, the application might also include a *motos*, a type of tent or pledget keeping the medication in place: Oribasius, *Ecl. Med.* 83.4 (διὰ τε πυνουλοῦ ἔνιε καὶ διὰ μοτοῦ παρατιθείς).

576 See Riddle (1985) xxvi–xxvii and 14.; Wellmann (1914) and *RE* V.1 (1903) col. 1131–42, s.v. “Dioskurides (12).”

577 Schoene (1903) 283, Bliquez (1984) 202, Fischer (1987) 37(37). If the emendation *puoulkos* be accepted for the nonsensical ms. reading *paulakion* at *Hippiatrica*, *Ex. Lugd.* 16 and 25, as proposed by Bliquez and Munro (2007) 490, the *puoulkos* was also of use to veterinarians in treating krithiasis. Likewise K.-D. Fischer suggests *per litteras* that *perpulcrum*, as read by E. Oder at *Mulomedicina Chironis* 651 (a disease of forelegs), be emended to *per pyulcum*.

578 See Majno (1975) 325–27; Bliquez, Oleson (1994).

579 Bliquez, Oleson (1994) 103.

used to extract, it received the name *puoulkos*. Note that neither Albucasis nor anyone else ever says an ear syringe could perform this function.

A unique tube has survived in an instrumentarium recovered from a tomb at Nea Paphos, Cyprus (Fig. 58a–b). The piece measures 20.2 cm in length and consists of a hollow reservoir tube to which there is attached, at its closed end, a slender pipe, open at its tip and possibly having a second, lateral opening. Remnants of wood on the interior of the reservoir tube suggest that a second tube of wood, used as a plunger, was fitted inside, in accord with Heron's directives. In addition to the tube/pipe apparatus, there was also among the items excavated from the tomb a fragmentary small "handle", also of copper alloy, that is taken to be part to the same instrument. If so, it would have been attached to the wooden plunger.⁵⁸⁰

The Nea Paphos tube ensemble is unique among surviving tools. Very likely the device is a piston-driven syringe, not a clyster nozzle to which a bladder would have been attached. Such a syringe could, no doubt, have performed the injections expected of an ear syringe. But, at over 20 cm, it is fairly large and apparently sturdy. If the handle associated with it is part of a plunger tube fitting tightly against the interior walls of the reservoir tube, as seems to be the case, the device is a prime candidate for identification as a *puoulkos*.

Finally, it is important to emphasize that, though Greco-Roman physicians were possessed of syringes that could expel and withdraw fluids, they had no sharp syringe for subcutaneous injections.⁵⁸¹

Irrigator for Penis?

The name *καυλοκλυστήρ* (*kaulokluster*) appears nowhere but on *Lists*.⁵⁸² This means that it had to occur somewhere in literature now lost to us. *Kaulos* in Greek means stalk and, by extension, other tubular objects and structures. These include uro-genital passages in animals and also the human penis.⁵⁸³ Therefore, the *kaulo-* segment of *kaulokluster* either reflected the shape of its tube/pipe, or its function. In support of the latter interpretation one can cite Celsus 6.18.2, where hot water is injected between glans and foreskin in cases of phimosis, and 6.18.5, where a carbuncle on the penis is irrigated with water.

580 Michaelides, (1984) 318(20) for tube, 320(33) for fragment of handle.

581 Majno (1975) 337.

582 Schoene (1903) 282; Bliquez (1984) 196. Fischer (1987) 38(46) sees the term as a corrupted form of *κεφαλοκλάστης*.

583 For animals, see Aristotle, *Hist. Animal.* 497a20, 510a26, 510b11; for the human penis see Hippocrates, *Internal Affections* 14P; Galen, *Meth. Healing* 10.301 & 381K = J-H 1.456–457 & 2.112–115; *Cmpds. by Place* 13.317K.

In both cases the tube used is the irrigator for ears (*clyster auricularis*); however, it is possible that when used for purposes of genital irrigation, this instrument was referred to as *kaulokluster*.

Bone Irrigator?

Only *Lists* attest an ὀστεγχύτης.⁵⁸⁴ On the analogy of *metrenchytes* and *otenchytes* this should be a bone irrigator, not an irrigator of bone. On the other hand it is not clear what bone surgeries required a tube of this sort. For this reason there is some skepticism about the name.⁵⁸⁵

Catheter

The Greeks have given to the Romans and to us the name catheter (καθετήρ, καθετήριον, τὸ καθετήρ ὄργανον).⁵⁸⁶ In the *Hippocratic Corpus* we also find the term αὐλίσκος (*auliskos*). This reappears in Rufus.⁵⁸⁷ Later Aëtius applies the name *auliskos* to a slender catheter tube to be inserted through another tube, itself called *katheter* (6.34.22). The catheter's shaft is once called *surinx* by Paul (6.59.1, διὰ τῆς τοῦ καθετηρίου σύριγγος).⁵⁸⁸ He also once uses the term διὰ κλυστηριδίου where he must be referring to a catheter (3.45.7). Although the name occurs in no surviving Greek text, Caelius Aurelianus (*Chron. Diseases* 2.1.23) says that, when used for irrigation, the Greeks call the part to which a little bag (*folliculus*) can be attached, therefore the end of the tube that remains outside the urethra, *cystophilos*. As to other Latin terminology, Celsus calls the catheter *fistula aenea* or 'bronze tube' (7.26.1), the same term as he gives to the tube he uses to drain dropsy. When Paul refers at 6.59.1 to the *puren* of the catheter, a term ordinarily reserved for the olivary enlargement on probes, he must mean its rounded head. Its eye or opening at the head he refers to in the same

584 Schoene (1903) 282; Bliquez (1984) 196.

585 Fischer (1987) 38(52). Hippocrates and Galen cool crown drills with water in the course of trephining to prevent exfoliation; accordingly one might irrigate bone during this procedure for the same reason. See above, Drills, under Bone and Tooth Instruments.

586 For the latter name see Aretaeus, *Care Acute Diseases* 1.4.16 & 2.9.5. While it is clear that the noun καθετήρ derives from the verb καθίζμι ('let or send down'), it is uncertain whether the name was meant to reflect the action of letting the instrument down into the bladder, letting urine descend from the bladder, or even letting an injection down into the bladder.

587 *Dis. of Kidney and Bladder* 7.11.1, 10.3.1, 12.3.2.

588 *Syrinx*, probably in the sense of a klyster tube, occurs once in Vegetius (1.28.7).

passage as its τρήμα (*trema*), while Galen prefers the term στόμιον (*stomion*).⁵⁸⁹ References to the catheter occur in Byzantine texts including *Lists*.⁵⁹⁰

Aëtius (11.5. 83) and Paul (6.59.1) speak of catheters appropriate to the age and sex of the patient (πρὸς ἡλικίαν καὶ γένος ἀρμόζοντα καθετήρα). Celsus advises us to have a number of sizes available: three for men, two for women. These he says should be of copper alloy and smooth. In the case of males they should be longer and more curved, measuring 15, 12 and 9 inches in length; in the case of women shorter models are recommended, measuring 9 and 6 inches respectively.⁵⁹¹ Rufus of Ephesus and Pseudo-Galen likewise distinguish male and female types, the former likening the male catheter to the collarbone, the latter to the Roman letter 'S'.⁵⁹² Galen several times refers to models with straighter bores.⁵⁹³

Pseudo-Galen asserts that the S-shaped catheter was developed by Erasistratus of Iulis in the Hellenistic period. Some have accepted this.⁵⁹⁴ However, the Hippocratics too had available catheter tubes and these must have assumed the S-shape in the case of males.⁵⁹⁵ If so, Pseudo-Galen is in error. Perhaps Erasistratus' contribution to the development of the catheter involved a refinement, or application of the tube in previously unheard of situations. Note that Caelius Aurelianus seems to connect Erasistratus with innovation in the use of the catheter when he remarks, "Besides, when the

589 *Aff. Parts* 8.408K.

590 Leon Iatrosophistes, *Consp. Med.* 6.4.5; Psellus, Poema 9, *De medicina*, line 1370. For *Lists* see Schöne (1903) 282; Bliquez (1984) 199; Fischer (1987) 37(40). For the role of the catheter and other instruments in Byzantine lithotripsy see Marketos et al., (1994) 74, 405–8.

591 *Ergo aeneae fistulae fiunt, quae ut omni corpori, amplior<i> minorique, sufficient, ad mares tres, ad feminas duae medico habendae sunt: ex uirilibus maxima decem et quinque est digitorum, media duodecim, minima nouem: ex mulieribus maior nouem, minor sex. Incuruas uero esse eas paulum, sed magis uiriles oportet, leuisque admodum ac neque nimis plenas <ne>que nimis tenues* (7.26.1-B).

592 Rufus, *On Bones* 12.2: ἡ δὲ κλείς τριβολοειδῶς ἐσχηματισμένη ἐμφέρειαν ἔχει καθετήρι ἀρρηγνικῶ; Pseudo-Galen, *Intro. or Physician* 14.788K = Petit 19.12: ἔοικε δὲ ὁ καθετήρ τῷ ῥωμαϊκῶ σίγμα Σ.

593 [Veins and arteries of the uterus, bladder and intestines require injections] διὰ τῶν εὐθυτρήτων καθετήρων. . . . ὀργάνων . . . τῶν εἶσω παραπεμπόντων αὐτὰ, μητρεγχυτῶν δηλονότι καὶ καθετήρος εὐθυτρήτου καὶ κλυστήρος (*Meth. Healing* 10.328 & 337K = J-H 2.34–35 & 48–49).

594 See Max Wellmann: RE, s.v. "Erasistratus"; Gurlt (1898) 309 and John Scarborough's entry "Erasistratus of Iulis" in Keyser and Irby-Massie (2008) 294–296.

595 *Diseases* 1.6P.

peritoneum is paralyzed, as Erasistratus says, the urine is held back and is not voided unless you introduce a catheter.”⁵⁹⁶

In general the catheter was developed to evacuate the bladder;⁵⁹⁷ alternatively, fitted with a bladder or skin bag of an animal it could function as a clyster in irrigating the urinary tract for abscesses and inflammation.⁵⁹⁸ Aëtius uses the catheter to clear the way for another catheter, which he calls an *auliskos* (6.34). The latter, being quite narrow (στενώτατος), is inserted into the former and performs the actual injection. Caelius Aurelianus (*Chron. Diseases* 2.1.23) inserts an ear syringe into the catheter for the same purpose. Paul too irrigates the bladder with ear syringes/clysters but independently of the catheter. In cases where an ear syringe/clyster proves impractical, he recommends attaching the skin or bladder of an ox to a catheter to drive the injection (6.59.2).⁵⁹⁹

We also hear that the catheter could be employed to thrust a stone lodged in the neck of the bladder back into the bladder itself;⁶⁰⁰ and Galen records an instance of the catheter breaking through scar tissue blocking the urinary passage.⁶⁰¹ In other applications Caelius Aurelianus (*Chron. Diseases* 3.8.133)

596 *Chron. Diseases* 2.1.13: *praeterea etiam peritoneo paralysi vitiato, ut Erasistratus ait, urina abstinetur et neque excluditur nisi adhibito catheteri.*

597 Paul (6.59) gives a detailed account of the process employed on males. Celsus' narrative is equally detailed, referring also (if briefly) to catheterization of females (7.26.1B); so too Aëtius 16.22.70 [Aspasia]. Pseudo-Galen (*Intro. or Physician* 14.788K = Petit 19.12) may also be consulted. Curiously, Paul plugs the eye end of the catheter with wool, which is withdrawn by a linen thread to draw down the urine on the principle of a siphon. This process Paul refers to as *euodiasmos*; see also Pseudo-Galen (*loc. cit.*) and Alexander of Aphrodisias (*Prob.* 2.59.1–4). Milne (1907) 144 suggested that this procedure, while based on erroneous theory, would have been effective in cases of cancer of the prostate, the wool keeping the eye of the instrument from becoming blocked prior to entering the bladder.

598 Rufus, *Dis. of Kidney and Bladder* 10.3.1–2 (hemorrhage from penis); Aëtius 11.27.28 (bladder hemorrhage and thrombi [Rufus]); Caelius Aurelianus, *Chron. Diseases* 5.10.124 (injection by clyster or catheter for internal abscesses of kidney, bladder, or urinary canal); Oribasius, *Ecl. Med.* 62.3 (kidney disease).

599 εἰ δὲ μὴ δυνατόν εἴη, τῷ καθετήρι προσαρμόσαντες τὸ δέρμα ἢ κύστιν βοείαν διὰ τῆς τοῦ καθετήρος ἐνέσεως ἐγγλύσομεν.

600 See, e.g. Galen, *Aff. Parts* 8.11K: εἰ δὲ διασείσαντος καὶ νῦν ἔτι μένοι, διὰ τοῦ καλουμένου καθετήρος ἅμα μὲν ἀπώσῃ τὸν λίθον ἐκ τοῦ τραχήλου τῆς κύστεως, ἅμα δὲ ποδηγήσεις τοῖς οὖροις. So too Aretaeus, *Care Acute Diseases* 2.9.5; Soranus, *Gyn.* 4.7.8 Ilberg = 4.4.62–67 BGM; Rufus, *Dis. of Kidney and Bladder* 12.3.1–2; Aëtius, 16.22.68 [Aspasia]; and Paul 3.45.3.21. In Aëtius the stone promotes dystocia; in the other sources ischouria or dysouria.

601 *Aff. Parts* 8.12K.

deploys the female model to drain ascitis. The male and female catheters could also be used as guards, analogous to the *meningophulax*. For example, Aëtius protects the urethra with a catheter when opening an imperforate vagina.⁶⁰² Similarly, Antyllus and Heliodorus insert the catheter to position and guard the neck of the bladder when incising a fistula.⁶⁰³ Lubrication of the catheter by olive oil facilitated its introduction into the urethra (Paul, 6.59.1: ... καθήσομεν εἰς ἔλαιον τὸν καθετήρα).

There are several references cautioning against evacuation by catheter in the case of men (as opposed to women) while the bladder is inflamed (Galen, *Aff. Parts* 8.13K; Rufus, *Dis. of Kidney and Bladder* 7.11.1–3; Aëtius 11.26.31, who copies Rufus; and Paul 3.45.11.16). Galen gives the impression that catheterization was an activity for specialists (*Thrasybulus, Is Health Med. or Gymn.*? 5.844 & 850K, *Meth. Healing* 10.301K = J-H 1.456–457).

Two male genital conditions requiring catheterization with simple tubes are described in the literature. The first has to do with the cure for hypospadias in which the glans penis is slit and a tube called *solenidion* (σωληνίδιον) is inserted into the urethra to promote urination (Pseudo-Galen, *Intro. or Physician* 14.787K = Petit 19.11).⁶⁰⁴ The second involves destruction of the glans penis by gangrene. In this case a leaden tube (σωληνάριον μολυβοῦν) is employed for the same purpose (Paul 6.57.1).⁶⁰⁵

When Milne wrote in 1907, he knew of only one surviving male example and no female specimen.⁶⁰⁶ At present I can vouch for 15 examples of the former

602 ἔπειτα καθετήρα ὑποβάλλοντες τῇ οὐρήθρᾳ ἀσφαλείας χάριν, ἵνα μὴ πλανηθέντες ἀνωτέρω τὴν διαίρεσιν ποιησώμεθα, ἔπειτα διέλωμεν κατωτέρω τοῦ σηματομένου τόπου διὰ τοῦ καθετήρος· ἐπιτήθειον δὲ εἰς τοῦτο ἐργαλεῖον τὸ λογχητικόν (16.108.21).

603 ... καθιέσθω διὰ τῆς οὐρήθρας πρὸς τὴν ἡλικίαν καθετήρ, ἵνα ἐν τῇ χειρουργίᾳ διὰ τῆς ἀφῆς ἐκ διαδόσεως τοῦ καθετηρίου ἀντιλαμβανόμενοι τοῦ τῶν σωμάτων πάχους ἀσύντηκτον φυλάξωμεν τὸν τῆς κύστεως τράχηλον (in Oribasius, *Coll. Med.* 44.20.63).

604 θεραπευτέον δὲ τετρημένης τῆς βάλανου ἄκρας καὶ σωληνιδίου ἐντιθεμένου.

605 εἰ δὲ ὅλη ποτὲ δαπανηθεῖν ἢ βάλανος, σωληνάριον μολιβοῦν ἐνθέντες τῷ πόρῳ δι' αὐτοῦ κελεύσομεν ἀπουρεῖν τοὺς κάμνοντας. A similar situation involving a tube of lead is told of the presbyter Aaron by John of Ephesus, *Lives of the Eastern Saints*, ed. and trans. E.W. Brooks (Paris 1923–25), PO 18, 641–45. A silver tube (ἀργυροῦς καυλίσκος) used as a catheter is mentioned by Diodorus Siculus (32.11.3 = vol. XI, 455, Loeb Classical Library) in the story of Kallo[n]. This tale of surgery involving a sex change was later reproduced by Photius: see René Henry, ed. and trans., *Photius Bibliothèque*, Vol. 6: (*“codices” 242–245*) (Paris: Les Belles Lettres, 1971 [Budé series]) 130–131.

606 The ‘female’ specimen in Naples figured by Milne on Pl. XLV 2 does not conform to now-documented types. Milne was apparently dealing with one of the small straight tubes in the museum, but I cannot tell if it was one of those available to me in 1985.

and two of the latter that I have actually seen or consider well documented. All are of copper alloy. Male models include three from Alliano, two from Italy (Fig. 3, top row), Colophon (Fig. 59a–b), Baden, and (probably) Herculaneum (Fig. 1, bottom row, far left), respectively, with single examples from Ephesus(?), Neuss, Rome and Carnuntum.⁶⁰⁷ Female catheters are rarer. Here I know of only two survivals, one from Italy (Fig. 3, top row) and one from Carnuntum.⁶⁰⁸ The two male models and the one female type from Italy and the two male models from Colophon appear to have been created as sets. These sets, therefore, reflect the directives given in the literature for different sizes to be available for different situations. In addition we note that both types have the head of the catheter closed off with an opening or ‘eye’ positioned nearby (Fig. 59b); on the male specimens from Colophon and Italy the opposite end is flanged, rather like the *aspidiscus* Caelius Aurelianus describes for clysters. This feature is apparently also meant to make it easier to attach a bag for irrigation and, by providing counter surface, to promote the injection itself. In addition it would, as the rings on cannulae (see below), prevent the instrument from slipping into the urethra and provide purchase for removing it. It may be this flange that Caelius refers to with the term *cystophilos*.⁶⁰⁹

Cannula

We have already observed tin drainage tubes for empyema in the *Hippocratic Corpus*.⁶¹⁰ Imperial authorities generally prefer burning and not intubation for this surgery.⁶¹¹ However, Celsus, Caelius Aurelianus and Paul insert tubes through an abdominal incision for draining ascitis or dropsy. These tubes are called *fistula* and *kalamiskos* respectively, Celsus recommending a *fistula* of lead or copper alloy (*plumbea aut aenea fistula*, 7.15.1–2), Paul mentioning copper alloy alone (6.50.2–3: χαλκοῦς καλαμίσκος).⁶¹² Both authorities warn

607 See Baykan (2012) 134(252–254) & 202 Figg. 10 & 11, Alliano; Jackson (1986) 126(20–21), Italy; Caton (1914) 116(v), Colophon; Milne (1907) 144 & Bliquez, Jackson (1994) 169(235) and 4(S), Naples, likely from Herculaneum; Brunner (1893) 42, Baden; Künzl (1991a) 48(32) and (1991aa) 1 533(32), Ephesus(?); Simpson (1977) 563 & Fig. 1.11, Neuss; Tabanelli (1958) 143, Rome; Krug (1992) 156(7), Carnuntum.

608 See Jackson (1986) 126(22) Italy; Krug (1992) 156(8) Carnuntum.

609 The suffix *-philos* in the name *cystophilos*/κυστόφιλος strikes one as odd. It might reflect the idea of ‘attachment’, as in being ‘attached’ in a close personal relationship.

610 κασσιτέρινος μοτός (*Diseases* 2.47P). In the same passage we are advised by Hippocrates to inject a solution of warm wine and oil through an *auliskos* into the pocket formed by the empyema.

611 Pseudo-Galen being an exception (*Intro. or Physician* 14.744K = Petit 13.28).

612 The late veterinary collection, *Hippiatrica*, attests *auliskos* as well as *kalamiskos* in treatment of equine dropsy: *Ber.* 38.2.12: ἐντιθέναι καλαμίσκον, δι’ οὗ ῥύσις γίγνεται τοῦ ὑγροῦ; *Ber.*

against draining all the fluid at once in accord with Hippocratic directives (*Aphorisms* 4.6.27L).⁶¹³ Caelius Aurelianus too urges caution, warning that the *fistula* may injure the tissue of the peritoneum (*Chron. Diseases* 3.8.128 [against Asclepiades]). Finally, Galen in treating hydrocele drains with a tube he calls a *siphon*.⁶¹⁴

The *fistula* inserted by Celsus for dropsy is either flanged on one end or is equipped with a ring or collar around its shaft, so as not to sink too far into the abdomen; and the section inserted into the abdomen should, he says, be longer than the section left out.⁶¹⁵ Paul adds a further refinement: his χαλκοῦς καλαμίσκος has the end to be inserted bevelled off like a stylus to facilitate drainage.⁶¹⁶ Two tubes of copper alloy in Naples, answer strikingly to these specifications (Fig. 1, middle row, 2nd & 3rd from left and Fig. 6o).⁶¹⁷ One of them, featuring a bevelled tip and a large ring, answers closely to combined details of the instrument in Celsus and Paul. The other tube differs in having two openings (as opposed to bevelling) at its distal end and once sported a T-shaped device running its full length inserted into the proximal. These features have led some to consider the object a syringe or even a trocar.⁶¹⁸ However, the T-shaped insert cannot be shown to have been sharp, which would be necessary for a trocar, and it seems upon examination, to be less suited to be a plunger than a stopper (Milne calls it an ‘obturator’). In this case, the instrument will simply be a refined version of its fellow, the stopper allowing the surgeon to drain the empyema at his convenience, as Celsus and Paul direct.

38.4.10: ἐντιθέναι καλαμίσκον χαλκοῦν, δι’ οὗ ῥύσις γίγνεται τοῦ ὕγρου; *Ber.* 38.10.3: αὐλίσκον ἔμβαλε δι’ οὗ ὁ ἰχώρ διαφορηθεῖ. Vegetius (*De Mulomedicina* 1.43.4) favors tapping with an arrow followed by insertion of a *fistula centetalis* with multiple small openings (*minutis foraminibus multisque pertusam*), something along the lines of Fig. 57a–b.

613 See especially Paul: καὶ δι’ αὐτοῦ (sc. καλαμίσκου) τὸ ὕγρον κομισόμεθα σύμμετρον πρὸς τὴν δύναμιν ἀπτόμενοι τοῦ σφυγμοῦ. εἴτα τὸν καλαμίσκον κομισάμενοι στήσομεν τὸ ὕγρον· στήσεται γὰρ εὐθὺς ἐναλλάξ δοθείσης αὐτῆς τῆς διαιρέσεως.

614 *Meth. Healing* 10.988K = J-H 3.486–489: ἐπὶ μὲν τῆς ὑδροκίλης διὰ καθέσεως σίφωνος, ἐπὶ δὲ τῶν ὑδέρων διὰ παρακεντήσεως.

615 *eo tum plumbea aut aenea fistula coicienda est, uel recuruatis in exteriorem partem labris, uel in media circumsurgente quadam mora, ne tota intus delabi possit. Huius ea pars, quae intrat, paulo longior esse debet quam <quae extra,> ut ultra ulteriorem membranam procedat.*

616 μετὰ δὲ τοῦτο χαλκοῦν καλαμίσκον διὰ τε τῆς τοῦ ἐπιγαστρίου καὶ τῆς τοῦ περιτοναίου διαιρέσεως καθήσομεν ἔχοντα τὴν ἐκτομὴν παραπλησίαν τοῖς γραφικοῖς καλάμοις...

617 Bliquez, Jackson (1994) 169(236–237), both probably from Herculaneum. The fact that the ring on 237 (inv. no. 78009) is located close to the bevelled end, contrary to Celsus’ stipulation that part of the tube to be inserted be longer than the part left out, is slightly offputting.

618 Scoutetten, as cited in Milne (1907) 113.

Lately, there has been recovered at Alliano a tube of copper alloy 11.5 cm. in length (Fig. 61).⁶¹⁹ Like the tube in Naples with the T-shaped stopper it has two openings at its distal end; and, like both tubes in Naples, it is equipped with a collar, though its collar is smaller than in the case of the Naples specimens. A second distinction is that this collar can be moved up and down. This remarkable tube seems most suited to act as a cannula for draining, but its excavator also considers it functional as a clyster.

These tubes, however, are complex models. A simple, small, straight tube will have served well enough for evacuation of pus and water pockets, this apparently being the sort of tube the Hippocratics envisioned.⁶²⁰ At least one has come to light in a surgical instrumentarium (Nea Paphos) and several others were likely included in one.⁶²¹

For the possibility of paracentesis by trocar in cases of dropsy, see above, s.v. under Needles.

Plain tubes also served to protect surrounding tissue from probe-like cauteries and, occasionally, were themselves employed as cauteries (see above under Cauteries: Tube as a Cautery). Wide bored models were also found handy for freeing the barbs of missiles from surrounding tissue in the course of weapons extraction (Paul 6.88.4).

Finally, in treating the growth called *myrmekia*, Paul (6.87.1) attests a tube called *surrington*, noting that, while some, like Galen, burrow under and lever the growth up with the hard shaft of a feather (σύριγγι πτεροῦ σκληροῦ), others do so “with a small tube of copper alloy or iron/steel” (χαλκῶ ἢ σιδηρῶ συριγγίῳ).

Lists preserve only the names *kalamiskos* and *siphon*.⁶²²

Tubes to Prevent Contractions and Adhesions

I here employ Milne’s rubric for these instruments, though I part company with him in other respects.

From the Hippocratics to the late Empire we encounter tubes, the purpose of which was to prevent contraction and adhesion in the body’s orifices. In

619 Baykan (2012) 136(256) and 203 Figg. 12 & 13.

620 Majno (1975) 158 offers a useful illustration.

621 For Nea Paphos, see Michaelides, (1984) 319–20 (30). For other possibilities see Künzl (1991a) 50(35) and (1991aa) 1 534(35), allegedly Ephesus, now lost; Bliquez, Jackson (1994) 169(238–239), Pompeii (Fig. 1, bottom row, 2nd group from left). Two others are reported by V. Gazzaniga and C. Serarcangeli, (1999) 217–227, Rome. Attention might also be called to a fine tube 7 cm in length, probably from the Pompeii area, and now in Oxford, Mississippi; see Bliquez (1988), 46(42) with 74.4(42). All these tubes are of copper alloy. The one from Nea Paphos is said to be gilded.

622 Schoene (1903) 282–3; Bliquez (1984) 200, 202.

some cases they were annointed with medicament to treat the afflicted part. Such tubes might be inserted postoperatively into the nose, rectum, vagina, urethra, and even between the glans penis and foreskin. They went by various names, most already familiar, including: ἀλλίσκος, συρίγγιον, σωλήν and its diminutives σωληνάριον (*solenarion*) and σωληνίδιον in Greek, *fistula* in Latin.⁶²³ In some cases the tube featured lateral perforation. For example, after surgery for abscess with fistula in the sphincter, Antyllus and Heliodorus require insertion of a tin tube that is “open from without, and toward its lower part having rounded perforation (*trema*) midway for relief of flatulence.”⁶²⁴ An Athenian comedian calls the pips on a dice cube collectively *trema* (Austin-Cassel, *Poetae Comici Graeci* II, Ameipsias Fr. 19); so we could see here multiple perforations rather than one.

Other treatments involving employment of these tubes in the wake of surgery include:

Placement of leaden tubes (*solenaria*) in the nose after sawing away nasal polyp with a cord in the Hippocratic manner (Paul 6.25.3).⁶²⁵

Placement of a lead or tin *solen* to promote cicatrization after surgery for anal fistula (Oribasius, *Coll. Med.* 44.20.72 [Antyllus and Heliodorus]).⁶²⁶

Positioning a *solen* of lead wrapped in papyrus between forskin and glans after incisions for phimosis (Oribasius, *Coll. Med.* 50.5.7–8 [Antyllus],⁶²⁷ copied by Paul 6.55.2).

Stretching the prepuce over a lead *solenarion* and binding it in place to correct leipodermos (Galen, *Meth. Healing* 10.1001K = J-H 3.506–509).

623 Curiously, *Lists* incorporates none of these terms.

624 δεῖ δ' ἐν τῷ καιρῷ τῆς κατουλώσεως κασσιτέρινον σωλήνα κυκλοτερῆ ἐντιθέναι, ἔξωθεν μὲν ἀχανῆ, εἰς δὲ τὸ βάθος περιφερῆ τρήμα μέσον ἔχοντα πρὸς τὰς τῶν πνευμάτων ἀποδόσεις (in Oribasius, *Coll. Med.* 44.5.12–14).

625 ... ἐς ὕστερον δὲ καὶ τοῖς ἀφουλωτικοῖς χρησόμεθα τροχίσκοις μολίβινα σωληνάρια ταῖς ῥίσιν, εἰ δεῆσοι, παρὰ πᾶσαν τὴν θεραπείαν ἐφαρμόζοντες.

626 ... ἵνα μὴ φιμός γίγνεται, ἐν μὲν ταῖς πρώταις ἡμέραις πριαπίσκος ἐντιθέσθω, ἐν δὲ ταῖς ἐσχάταις πρὸς τὴν κατούλωσιν σωλὴν μολυβδοῦς ἢ κασσιτέρινος γιγνέσθω καὶ ἐντιθέσθω μεχρὶ κατουλώσεως.

627 μετὰ δὲ ταῦτα μολύβδου σωλήνα περιβαλοῦμεν τῇ βαλάνῳ πάσῃ, κατειλήσαντες αὐτὴν ἐσκελετευμένην παπύρῳ. οὕτω γὰρ διὰ τὴν τοῦ σωλήνος περίθεσιν κωλυθήσεται συμφῶναι πάλιν ἐπαχθεῖσα ἡ πόσθη.

Using a *solenarion* of copper alloy or tin over which to mold a tube of papyrus which, when dried and inserted into the urethra, keeps the passage open and allows for urination after surgery for occlusion. Subsequently, a *solenarion* of tin or lead with its proximal end flanged (ἀσπιδίσκην ἔχον προκειμένην) is introduced to promote cicatrization and healing (Oribasius, *Coll. Med.* 50.9.8–15).⁶²⁸

Placement of a leaden *auliskos* in the anus to avoid contraction after perforation of a blockage (Paul 6.81.1).⁶²⁹

Insertion of a leaden tube (*plumbea fistula*) into the anus to pressure a fistula to close in the wake of surgery for bladder stone (Celsus 7.27.8).⁶³⁰

In cases of occluded/imperforate female genitalia Celsus recommends a leaden tube (*plumbea fistula*) smeared with cicatricizing medication inserted into the vagina following surgery (7.28),⁶³¹ whereas Aëtius prefers a tube of tin (*suringion kassiterinon*, 16.108.34 & 55).⁶³²

Insertion of leaden tubes (*solenaria*) in treatment of a fractured nose with ulceration to prevent a subsequent growth/sarkoma (Paul 6.91.2).⁶³³

628 ... φυλάξαι δεῖ τὸν οὐρητικὸν πόρον ἐν εὐρύτητι· μάλιστα δ' ἀνευρύνεται ταῖς πρώταις ἡμέραις ἱπωτηρίου ἐντεθέντος τοῦ ἀπὸ τῆς ἐσκελετευμένης παπύρου. ἔχέτω δ' ἐν ἑαυτῷ τὸ ἱπωτήριον σωληνᾶριον χαλκοῦν ἢ κασσιτέρινον... σωληνᾶριον ἐντίθεται εἰς τὴν οὐρήθραν κασσιτέρινον ἢ μολυβδόυν, ἀσπιδίσκην ἔχον προκειμένην, ἵνα τῷ σωληναρίῳ διαστελλομένη ἡ οὐρήθρα κατολῶθῃ.

629 ἐπειδὴ δὲ καὶ τοῖς τελείοις πολλάκις δι' ἕλκος μὴ θεραπευθὲν καλῶς σύμφυσις κατὰ τὸν δακτύλιον γίνεταί, δεῖ ταύτην ἀναρρήξαντα δι' ὄργανου προσφόρου θεραπεύειν οἰκείως αὐλίσκου μολιβδίνου ἢ σφηνίσκου τινὸς ἐντιθεμένου τῷ δακτυλίῳ μέχρι τελείας ἀποθεραπείας ὑπὲρ τοῦ μὴ αὐθις συμφῶναι...

630 *Quod si fistulae metus ex is causis, quas proposui, subesse uidebitur, quo facilius cludatur ea u<el c>erte coangustetur, in anum quoque danda plumbea fistula est; extentisque cruribus femina talique inter se deligandi sunt, donec, qualis futura est, cicatrix sit.*

631 *cumque iam (ulcus) ad sanitatem tendet, plumbeam fistulam medicamento cicatricem inducent<e> inlin<e>re eamque intus dare, supraque idem medicamentum inicere, donec ad cicatricem plaga perueniat.*

632 ὅταν δὲ μέλλῃ κατολουθῆσαι, συρήγιον κασσιτέρινον ἐντίθει καὶ ἐπιδέσμευε, ἕως ἂν στερεοποιηθῶσιν οἱ τόποι... χρῆσθαι δὲ ἀπὸ τούτων τῇ διὰ σπύγγου καθέσει μέχρι τυλώσεως τῶν χειλῶν τοῦ στομίου, ἔπειτα δὲ καὶ συριγγίῳ κασσιτερίνῳ.

633 εἰ δὲ καὶ ἔσθωεν τῆς ῥινὸς ἕλκος εἴη γεγόνος, λημνίσκοις ἐκ μοτῶν χρισθεῖσιν θεραπεύειν. τινὲς δὲ καὶ μολιβδίνοις σωληναρίοις ἄχρις ἀφουλώσεως ἐχρήσαντο διὰ τὸ μὴ σάρκωμα ἐκ τῶν ἑλκῶν ἐπιτραφῆναι.

Milne identified three tubes of copper alloy in Naples as suitable for the purpose.⁶³⁴ Of these, the one he figures came from the House of the Surgeon and was certainly associated with surgery. Milne must also have intended as among his three tubes a slightly smaller piece closely resembling it (see Fig. 1, bottom row, far left; Fig. 55). This probably also derives from the House of the Surgeon.⁶³⁵ I have no idea which of the other tubes in Naples Milne took as his third example (Fig. 1, bottom row, 2nd group from left).

A tapering tube 9.7 cm. long in the Smithsonian also deserves mention (Fig. 57a–b). It compares favorably to the tube perforated along its shaft we have seen Antyllus and Heliodorus recommending for postoperative treatment of surgery for abscess with fistula in the sphincter. It is also equipped with the flanged rim (ἀσπίδισκη) at its proximal terminus that Oribasius prescribes for placement in the urethra after surgical removal of occluding tissue. However, this particular piece is rather too broad for urethral insertion and its medical provenience is undocumentable. The Smithsonian tube, the Neapolitan tubes, and all others identifiable as surgical from other sources are of copper alloy. In contrast, all but one of the literary references cited above require tubes of lead or tin. The reason for this is probably that lead and tin are malleable and the treatments under consideration may have required remolding the tube to suit the operation intended and the anatomy of different patients. I am therefore uncertain that a specimen of the adhesion/contraction tube envisaged by Imperial sources has yet come to light. The examples advanced by Milne might have been so used under certain conditions but they could just as well have served as clysters (as noted above), cannulae, or even insufflators (see below).

Tube to Guard Caution

See under Cauteries: Caution Applied through a Protective Tube

Tube and Bellows/Bladder

The Hippocratic treatment of injecting a blast of air into the rectum before administering an enema with either a tube attached to a bladder (*Affections* 21P) or with a blacksmith's bellows (*Diseases* 3.14P) in cases of severe intestinal blockage (ileus) is approved by Alexander of Tralles under certain conditions, though he recommends that a 'physician's tube' (*auliskos*) be attached to the bellows.⁶³⁶ Cassius Felix requires in addition a length of bovine intestine

634 Milne (1907) 114.

635 Bliquez, Jackson (1994) 26, 55, 80, 167(233–234).

636 λαβάν αὐλίσκον ἱατρικὸν ἐφάρμοσον αὐτὸν τῇ χαλκευτικῇ φύσῃ καὶ, ὅταν τοῦτο ποιήσης, διάστειλον αὐτὴν, ἕως οὗ θεάσῃ πᾶσαν πληρωθεῖσαν πνεύματος, καὶ τότε λοιπὸν ὡς ἐπὶ ἐνετῆρος

attached by sparto/esparto cord (made of Spanish broom) to the tube of the bellows on one side and to a tube of bone on the other.⁶³⁷ Soranus believed that a blast of air into the vagina via bellows and tube was also recommended by Hippocrates for hysterical suffocation (*Gyn.* 3.29.2 Ilberg = 3.5.124–128 BGM). Hippocrates does recommend inflation of the uterus but with tube and bladder, not bellows (*Nature of Women* 14P).⁶³⁸ Soranus rejects this approach as well as Diocles' method of reducing prolapsed uterus with the bellows treatment (*Gyn.* 4.36.9 Ilberg = 4.6.76–80 BGM).

In light of these applications, it is no surprise to see *φυσστήρ* (*phuseter*), another name for bellows, on *Lists*; the name *σαλπίγγιον* (*salpingion*), which has the same meaning, probably also occurs.⁶³⁹ Neither term is mentioned in classical surgical texts. However, Galen employs the *σαλπίγγιον* in anatomical dissection, comparing it to “the bellows used by goldsmiths” (τοῖς τῶν χρυσοχόων φυσστήρσιν).⁶⁴⁰

In veterinary texts tubes are used to inject air into the shoulders of horses to relieve chronic pain and dislocations.⁶⁴¹ In these cases inflation seems to have been oral.

πέμπε τὸ πνεῦμα συστειλας τὸν ἀσκόν. εἶτα μετὰ τοῦτο κλύσον παραυτὰ δι' ὀλίγου νίτρου καὶ ὕδρελαιού· (*Therap.* 2.363.13–23).

637 *Intestina bubula, mensura cubiti unius, tubulo folliculi diligenter sparto ab una parte ligabis. Similiter iterum altram partem ipsius intestini osseo aulisco ligabis...* (5.1.13). Caelius Aurelianus altogether disapproves of the procedure (*Acute Diseases* 3.17.154 & 156–157). A treatment for ileus of the womb is recommended in similar language in the Hippocratic *Diseases of Women* 8.131.5–6L, only in this case warm olive oil is injected through the *auliskos*. For esparto (*stipa tenacissima* L.) see, p. 555, col. 2 in George Usher, *Dictionary of Plants Used by Man* (London: Constable, 1974).

638 The confusion is caused by Soranus' inexact memory. [Hippocrates], *Diseases of Women* 8.131.1L speaks of the uterus as behaving in the same way as an obstructed bowel (αἱ μήτραι εἰλέωσι σφέας); so, as the *χαλκευτική* φύσα was used to cure the latter, it is easy to see how it was also assumed useful for hysterical suffocation.

639 For *phuseter*: Schoene (1903) 284; Bliquez (1984) 203. For *salpingion*: Schoene (1903) 283; Bliquez (1984) 197; Fischer (1987) 37(39) who suggests a catheter.

640 *Anat. Proc.* 2.717K = 11.563Gar.

641 *Hippiatrica*, Ber. 26.7.6–7 (ἐμβάλειν τὸν καλαμίσκον, φυσῶντος ἐτέρου τὸ πνεῦμα); 26.9.9 (ἐνθέντες αὐλίσκον ἐμφυσᾶν εὐρώστως); 26.16.1 & 3 (ἐνθεῖς αὐλίσκον ἐμφύσα), 26.18.9 (ἐντιθέναι αὐλίσκον καὶ ἐμφυσᾶν εὐρώστως); *Ex. Lugd.* 30.1–2 (λαβὼν αὐλίσκον μικρὸν φύσα).

Tubes for Insufflation and Extraction

There are abundant references in the literature to application of medicaments by blowing them through a tube into the nose and throat.⁶⁴² In the main we hear of reeds deployed for the purpose. Oribasius, for example, blows styptics for nosebleed διὰ καλαμίσκου (*Syn.* 7.20.15 = *Eunap.* 3.36.15), Aretaeus sternutatories for severe headache (kephalaia) καλάμῳ (*Care Chron. Diseases* 1.2.5) and Galen and Theodorus Priscianus a compound for nasal polyp διὰ καλαμίδος (*Cmpds. by Place* 12.685K [Philoxenus]) and *per cannulam* (*Eup.* 1.43) respectively. In insufflating for the same and other conditions Galen also records sources naming the tube as συρίγγιον/*suringion* (*Cmpds. by Place* 12. 683K [Lampon]) and σίφων/*siphon* (*Cmpds. by Place* 12.679K [Archigenes]). *Siphon* is the preferred name for Dioscorides, when he applies ground white copper to the ear for chronic deafness (*Mat. Med.* 5.77.3), and also for the author of *Euporista or Simples* 1.151.1, who blows catmint into the nose to treat fetid nasal polyp. Interestingly, the latter also applies the term *siphon* to the tube he employs for various fumigations, once making it clear that the *siphon* is only a simple reed.⁶⁴³ Aretaeus also mentions thick and long goose quills used as insufflators for throat conditions.⁶⁴⁴ The fact that reeds and quills are biodegradable would explain why no such insufflating tube survives. However, Oribasius documents tubes of copper alloy as well. These, he says should be about six inches long.⁶⁴⁵ One such splendid specimen survives in the instrumentarium of the Surgeon of Paris (Fig. 62). It consists of a tube with a soldered seam, featuring a small shovel at one terminus. On this the powdered medicament was positioned as the physician blew into the opposite end.⁶⁴⁶

642 The procedure is even found in veterinary texts: *Hippiat. Ber.* 97.8.11–12: πάντα κόψας καὶ σήσας λεπτῷ κοσκίνῳ ἐμφύσα διὰ καλαμίσκου εἰς τοὺς μυκτῆρας (to clear the passages during spring grazing); *Add. Lond. ad Cantabrig.* 13.5: ἐμφύσσα διὰ καλαμίσκου (leukoma). Pelagonius 468 admisters fine glass powder *per fusetem* to remove *album de oculo*.

643 2.35.1: διὰ καλαμίνου σίφωνος καὶ ἄμβικος τετρημένου κατὰ τὸν πυθμένα.

644 *Care Acute Diseases* 1.9.2: . . . ἐμφυσῆν καλάμῳ ἢ πτίλῳ ἢ καυλῷ παχέϊ καὶ ἐπιμηκέϊ. The same language is used for the sternutatories: *Care Chron. Diseases* 1.2.5: καλάμῳ ἐμφυσῆν ἢ καυλῷ πτεροῦ χηνὸς παχέϊ.

645 *Coll. Med.* 8.13 (sternutatories) [Antyllus]: ἐντίθεται κάλαμος λεπτὸς ευθύτρητος, εἰς τὸν μυκτῆρα ἐμβῆναι δυνάμενος, μήκος ἔχων δακτύλων ἕξ. πληροῦται δ' ἢ τοῦ καλάμου ἐνρυχωρία πᾶσα τοῦ φαρμάκου. ἔστω ὁ κάλαμος φυσικὸς ἢ χαλκοῦς. ἐμβιβασθέντος δ' αὐτοῦ, ἐμφυσῶμεν κατὰ τὸ ἔτερον πέρας ἢ ἐμβάλλομεν τὸ φάρμακον εἰς τὸν μυκτῆρα.

646 Künzl (1983a) 77(26). Meyer-Steineg claimed a small tube-spoon combination in his collection, allegedly from Kos, was intended for insufflation (1912 42). It is now lost; see Künzl (1991a) 58(62) and (1991aa) 1 539(62).

In Oribasius we find a *siphon* being used to suck out water confined in an ear.⁶⁴⁷ Alexander of Tralles also employs a little tube (*aulidion*) in this way for clearing the ear.⁶⁴⁸

Tube as Straw

In preparation and consumption of medications, a tube used as a straw proves handy, as in these testimonia:

Aëtius 7.106.43–6 (preparing a *collyrium*/eye salve): When we have ground and sifted the ingredients with a fine sieve, we put them in a shallow mortar, add pure spring water, emulsify and let stand. Next we draw off the water along with the congealed surface with a *siphon* . . . We do this often until nothing more is congealed on the water.⁶⁴⁹

Aëtius 6.76.6–10 (cases of poisonous liquid in the ear canal): Goose fat helps. Also oral sucking draws out the liquid perfectly well; or instill onion juice mixed with goose fat when you have sucked it up with a reed (*kalamos*) as with a *siphon*. That is quite soothing.⁶⁵⁰

[Dioscorides], *Euporista or Simples* 2.32.1: Wine left over night in a hollowed out sea squirt (is effective) against severe coughing fits . . . it should be taken with a *siphon* and in small mounts owing to its bitterness.⁶⁵¹

In this category may be included a horn (type unspecified), through which oral medication was administered to horses (*Hippiatrica*, *Ex. Lugd.* 12.5–6: διίδου διὰ στόματος μετὰ κέρατος).

647 Oribasius, *Ecl. Med.* 10.4: ὕδατος ἐναποληφθέντος εἰς το οὖς, ἔνσταζε χυλὸν κρομμύου ἢ διὰ καλάμου ἐκμύζα ὥς διὰ σίφωνος.

648 *Therap.* 2.97.7: ἀναπτύεται γὰρ διὰ τοῦ ὑγροῦ πολλάκις τὸ ἐμπεσόν καὶ διὰ τριχολαβίου εὐχερῶς ἔλκεται. καὶ αὐλιδίων τινες ἐμβαλόντες τῇ ἀκοῇ, εἴτα τῷ στόματι ἐκμυζήσαντες ἡδυνήθησαν τῷ τρόπῳ τούτῳ ἐπισπασάμενοι ἔλκυσαι.

649 εἴτα κόψαντες σήσαντες λεπτοτάτῳ κοσκίνῳ καὶ βαλόντες εἰς θυίαν τινὰ οὐ βαθεῖαν καὶ ἐπιβάλλοντες ὕδωρ πηγαῖον καθαρὸν λειοῦμεν· εἴτα ἐάσαντες καταστήναι, σίφωνι ἀνασπῶμεν τὸ ὕδωρ σὺν τῷ ἐφισταμένῳ ἐπιπάγῳ· . . . καὶ τοῦτο ποιοῦμεν πλειστάκις, ἄχρι μηκέτι ἐφίστηται τῷ ὕδατι ἐπίπαγος.

650 ὠφελεῖ δὲ αὐτοὺς καὶ τὸ χήνειον στέαρ· ἄκρως δὲ καὶ ὁ διὰ τοῦ στόματος ἐκμυζήσιμος ἐπισπᾶται τὸ ὕδωρ· ἢ καλάμῳ ἐκμυζήσας ὥς διὰ σίφωος, ἔνσταζε χυλὸν κρομμύου μετὰ χηνείου στέατος· παρηγορεῖ γὰρ πάννυ.

651 τὰς δὲ σφοδρὰς ἐπιπτώσεις τῆς βηχὸς ὠφελεῖ οἶνος ἐν σκίλλῃ ἐγγλυφείῃ διανυκτερεύσας . . . σίφωνι δὲ λαμβανέσθω, καὶ ὀλιγὸς διὰ τὴν δριμύτητα.

Tube to Prevent Hemorrhage

Galen inserts a κοῖλος κάλαμος or a χαλκοῦς αὐλίσκος into a large artery to prevent blood loss in the course of an experiment involving pulse: *Blood in the Arteries* 4.733.

For tubes used in fumigation, see under Fumigation and Warming Devices.

Forceps

In a sense the forceps, like the probe is a mechanical substitute for fingers. Indeed, authorities like Celsus and Paul equate the two, and Stephanus of Athens notes that a surgeon should have long fingernails specifically for this reason.⁶⁵²

There are frequent references in the literature to instruments that functioned as forceps, and many objects excavated from surgical proveniences are readily recognizable as such. Some of the forceps recovered are two-piece instruments revolving on a pivot, like a pair of hand pliers; some are one-piece spring types. Some models have slender legs coming to a point (some with rifled faceting on the inner face of the pointed tips), whereas others have broad legs ending in jaws.⁶⁵³ Some forceps have inward curving jaws or jaws that curve off together in one direction (the so called *coudée* type, Fig. 2, bottom row, 13th from left; Fig. 3, middle row, 9th from rt.; Fig. 11.9), while others feature straight jaws. Some jaws are dentated/serrated with interlocking teeth at their termini, some not; others are hollow, and of these, some are dentated/serrated along their edges and some are smooth. Finally, of the two-piece models, some have jaws lying in the same plane as the handles, while some are offset from the handles like a bayonet. A few specimens of forceps are equipped with sliding catches so that their jaws can be fixed/bound in place. Sometimes a forceps is combined with another instrument as the forceps-elevator combination at Aschersleben (Fig. 38.2), two forceps combined (probably) with a knife (Italy), and the sharp hook mounted opposite a forceps in Cologne.⁶⁵⁴

To date the Domus 'del chirurgo' at Rimini has provided the richest cache of forceps in one location, over 30 specimens in all.

652 Celsus 7.5.2B–C (removal of arrowheads, *vel digitis . . . vel forfice*), 7.5.4B (removal of sling-shot bullets, *vel manu . . . vel forfice*), 7.12.1B (pulling teeth, *manu . . . forfice*); Paul 6.90.5 (removal of skull fragments, εἰ μὲν δυνατόν, τοῖς δακτύλοις, εἰ δὲ μή, ἰδοντάγρᾳ ἢ ὁστάγρᾳ ἢ τριχολαβίδι ἢ τοιοῦτῳ τινί.). For Stephanus see ed. of Westerink (1985–1995) 43.

653 For these features see Jackson (1986) 138.

654 Grimm (1936) 105; Künzl (1983a) 101(80.2), also 77 (51.29); Jackson (1986) 123(10 & 11). For Cologne, again see Jackson (1986) 140, note 64.

The chief problem in dealing with the Greco-Roman forceps is coordinating the literary testimonia with the archaeological survivals. Physical description of a forceps given a particular name, e.g. 'bone forceps', is often scanty or non-existent. Also it appears that, in some cases, different names were applied to the same surviving type. These difficulties have to be borne in mind in all attempts to distinguish the various types to which the literary sources bear witness.

Smooth Jawed Spring Forceps

In Imperial sources written in Greek we find a forceps called λαβίς/*labis* and its diminutive *labidion* prescribed for a number of non- to relatively non-heavy duty procedures. This suggests ordinary cosmetic tweezers with smooth jaws of varying width, such as abound at sites like Pompeii (Fig. 2, bottom row, 11th & 12th from left) but are also found in surgical contexts (Fig. 3, middle row, 7th & 8th from rt.; Fig. 38.2, combined with lever). The name derives from the verb λέγω, meaning 'pick out', 'select.' I find only one modifier, that for a narrow jawed model for plucking a small bladder stone from the tip of the male urethra.⁶⁵⁵ As one of the instrument's functions is the removal of offending eyelashes in cases of trichiasis, we are not surprised also to find the compound τριχολαβίς (*tricholabis*), as well as τριχολάβον (Latin *tricholabon*) and its diminutive τριχολάβιον.⁶⁵⁶ Another name for the instrument was ἀθερολόγιον and perhaps ἐθειρολόγος (compounded of ἔθειρα 'hair' and λέγω; cf. the Hippocratic ὀστεολόγον or 'bone forceps').⁶⁵⁷ The latter is unattested in surviving literary texts but appears on *Lists*, as does the compound *perilabeus*, which may be yet another name.⁶⁵⁸ Ὀξυλαβίδιον also occurs on *Lists*, the first element of which ('sharp, keen, pointed') suggests a type with slender pointed legs, such as those shown in Fig. 3, middle row, 7th from right.⁶⁵⁹ The Latin term for this type of forceps was likely *volsella* (see below).

Other uses for the *labis/tricholabis/volsella*, etc., include manipulation of ingredients in the preparation of materia medica (Dioscorides, *Mat. Med.* 1.68.7; Oribasius, *Coll. Med.* 11.lambd 7. line 34; Aëtius 1.253.1), and especially removal of foreign objects from eyes (Oribasius, *Eunap.* 4.31.3; Aëtius 7.21.2 &

655 Rufus, *Dis. of Kidney and Bladder* 3.16.4; Pseudo-Galen, *Kidney Diseases*, 19.659K; Aëtius 11.5.92: τῇ οὖν στενῇ λαβίδι ἡδυνήθημεν τοῦτον ἐξελκύσαι [Philagrius].

656 See respectively: Oribasius, *Eunap.* 4.20.1; *Lists* = Schoene (1903) 283, Bliquez (1983) 203, Fischer (1987) 36(24); and Paul 6.13.1.

657 Fischer (1987) 36(20).

658 Schoene (1903) 283; Bliquez (1983) 196, 203; Fischer (1987) 38(48).

659 Schöne (1903) 282; Bliquez (1983) 196.

6 = Hirschberg, Waugh pp. 28–29. Chp. 21), from nose and ears (Galen, *Cmpds. by Place* 12.659 & 688K [Apollonius]; Alexander of Tralles, *Therap.* 2.97.6; Paul 6.24.1), fish bones from the throat (Aëtius 8.53.9), bone fragments in cases of skull fractures (Oribasius, *Coll. Med.* 46.11.30; Paul 6.90.5) and nasal fracture (Celsus 8.5.5; Paul, 6.91.2), and left over bone scales in tooth extraction (Celsus 7.12.1D). Likewise remnants of growths such as nasal polyps are said to be removed by the *labis* following application of destructive medicaments (Galen, *Cmpds. by Place* 12.687–688K; Aëtius 6.91.73), while veterinarians found the tool useful for plucking worms from the tongues of cattle (*Hippiat., Frag. Anatolii de bubus* 12.4.3). Finally, Aëtius maintains that viper's venom can be retrieved by using the *labis* to apply the severed but warm neck of the creature to the bite.⁶⁶⁰

Dentated Spring Forceps

The most frequently used term of all for a forceps is *μύδιον*/*mudion* (Latin *myzon*). That the *mudion* was a spring forceps is suggested by the fact that this name also designated a bivalve mussel.⁶⁶¹ We also find it at least once applied to a small boat (Diodorus Siculus 31.38) which, one imagines, had a pointed (and maybe a peaked) prow and therefore resembled, e.g., the jaws on the coudée forceps. The diminutive form *μύδιον* (as *volSELLa* below) shows that the instrument was usually small. That its legs might be incurved at their terminus can be deduced from the once occurring variant *μυδιόσκελλον*, -σκελλον, meaning crook-legged (Aëtius 8.27.15; *LSJ* s.v. *σκελλός*). Aëtius 16.115.13 is evidence that the *mudion* might have broad jaws (*μυδίω πλατυστόμω*), and 16.115.14 and 16.117.37 in the same author show that the jaws might be serrated or dentated (*παρὰ τοὺς ὀδόντας τοῦ μυδίου*). Examples of this type from Pompeii and Rimini are shown in Fig. 2, middle row and Figs. 11.8–11. Specimens from Italy in the British Museum and from Pompeii and Rimini represent the variant known as coudée. Like the common dentated type these have interlocking toothed jaws, but the jaws are broader and angle off to one side (Fig. 2, bottom row, 13th from left; Fig. 3, middle row, 9th from rt.; Fig. 11.9).⁶⁶² Note that some of these pieces are equipped with sliding catches to keep the arms and jaws in place and that

660 τὴν δὲ ἀποκοπεῖσαν κεφαλὴν λαβίδι κατέχων ἀκριβῶς ἐπιτίθει τῷ δῆγματι τὸ πρὸς τὸν τράχηλον μέρος ἔνθερμον καὶ ἀφαιρήσεις τὸ ἰόν (13.23.31–33). The treatment is repeated for equines in *Hippiatrica Cantabrig.* 71.7.

661 Aëtius 16.21.27.

662 For other examples of the coudée forceps and further speculation on its applications see Jackson, Leahy (1990).

the specimen in the British Museum features a slot, probably for an iron/steel blade. A particularly ornate specimen from Colophon can be seen in Fig. 69.⁶⁶³

We cannot assume that the term *mudion* was *always* applied to a forceps with broad incurving dentated jaws. Note among the specimens shown in Fig. 3 one closely resembling its incurved dentated partner but itself lacking dentation (middle row, 8th from rt.). To further complicate matters, I suspect that *labis* and *mudion* were interchangeable terms, and that they sometimes designated still other forceps type (see e.g., Uvula Forceps below).

We are confronted with the same difficulty when we consider Latin terms for the forceps. Celsus, our principal source, employs both a *volsella* and a *forfex*; others like Cassius Felix use a *forceps*. No author offers modifiers that might distinguish these terms; so, we have to go on their functions to match them with recovered specimens. In general, it would seem that *forfex/forceps* represents a heavier duty pliers-like forceps (as the models treated below),⁶⁶⁴ *volsella* a spring type. To judge by its uses, the jaws of the *volsella* might be smooth and pointed, as when employed to extract bone fragments in cases of tooth extraction and nasal fracture (Celsus, 7.12.1D; 8.5.5); or its jaws might be dentated when deployed, as was the *mudion*, in the following surgical procedures where Greco-Roman surgeons found the *mudion/volsella* especially useful in positioning tissue for the scalpel:

Eye surgery: Aëtius 7.64.2 (positioning encanthis for excision) = Hirschberg, Waugh pp. 98–99. Chp. 64.

Oral surgery: Aëtius 8.27.15 (positioning epulis for excision); Aëtius 8.44.8 & 13, Paul 6.31.2, Celsus, 7.12.3, and Pseudo-Galen, *Intro. or Physician* 14.785K = Petit 19.10 (positioning uvula for uvulectomy); Celsus, 7.12.4 (stretching tongue to free frenulum in cases of ankyloglossia; cf. Cicero *On Divination* 2.96).

Urogenital and anal surgery:⁶⁶⁵ Celsus 6.18.3 (raising gangrenous foreskin); Oribasius, *Coll. Med.* 50.9.6 (removal of tissue blocking male urethra [Heliodorus]); Celsus 7.28.2 (removal of tissue causing vaginal occlusion); Aëtius 16.115.13–17

663 A specimen from Alliano shows a similarly elaborate finial; see Baykan (2012) cover & 144(293).

664 Note that *Herm. Mon.* calls the heavy-duty *odontagra* (see below) *forfex dentarie* (207.57).

665 There is a fine dentated model with jaws angled to one side in the Cambridge Museum of Classical Archeology; see (Künzl 1983b) Taf. 63.1. As it is part of a set of instruments for lithotomy, it must have been used for the extraction of bladder stone and be distinct from the narrow legged type referred to by Aëtius, for plucking a stone from the tip of the urethra (11.5.92).

[Philumenus], Muscio 11 25, p. 106, and Paul 6.70.1 (positioning hypertrophied nympha for amputation); Aëtius 14.11, Cornarius [Leonides] (positioning callus and fissures for excision in wake of opening fistula); Aëtius 16.116. 5 and Muscio 11 26, p. 106 (positioning kerkosis, a fleshy outgrowth from mouth of uterus, for excision); Aëtius 14.4 & 13, Cornarius [Leonides], Aëtius 16.117.11 & 37, and Paul 6.71.1 (positioning thymi, condylomata, and hemorrhoids of female genitalia for excision); Paul 3.75.2 and Muscio 11 30, p. 110 (positioning for excision uterine hemorrhoids); Aëtius 14.11, Cornarius [Leonides] (positioning wrinkles/rugae for excision in wake of incising fistula); Paul 6.78.2.21 (positioning callus of fistula for excision); Celsus 7.30.2, Aëtius 14.3, Cornarius and Paul 6.80.1 (positioning for excision condylomata = calloused tubercule formed in wrinkled skin of the anus or female parts).

Surgery on the skeleton: Oribasius, *Coll. Med.* 46.10.4 (retracting tissue in accessing fractures); Oribasius, *Coll. Med.* 47.15.2 (positioning supernumerary digit for amputation).

Other: Paul 6.87.1 (positioning *clavi* and *myrmecia* for excision); Philumenus, *Venomous Creatures* 2.6.8 and Pseudo-Dioscorides, *Venomous Creatures* [*Theriaca*] 2.32 (raising edges of a dog bite for excision).

Another term for the same instrument is likely *σαρκολάβος-ον/sarkolabon* (Latin: *sarcolabon*) or *σαρκολαβίς/sarkolabis*. The identification is implicit in the name itself (compare *τριχολάβον* and *τριχολαβίς*) and in the fact that the *sarkolabon* serves the same function as the *mudion* in a number of surgeries; i.e., positioning for excision: uterine hemorrhoids (Muscio 11 30, p. 110), ganglion (Oribasius, *Coll. Med.* 45.10.2 [Antyllus]; Paul 6.39.1), acrochordon and encanthis (Paul 6.17.1), and epulis (Paul 6.27.1).⁶⁶⁶ Not surprisingly, Muscio equates *sarkolabon* and *mudion*.⁶⁶⁷

We find the *sarcolabis* used as a hemostat and for seizing the growth called *pulmunculus* (*Mulomedicina Chironis* 102 & 667).

Curiously, though *mudion* is most frequently cited in the surgical literature, the name does not occur in Galen, nor in veterinary tracts; likewise, *sarkolabon* but not *mudion*, emerges on *Lists*.⁶⁶⁸

666 To these authorities we may add Dioscorides, who deploys a *sarkolabis* to pull away tumor and polyp after application of copper sulfate or verdigris (*Mat. Med.* 3.80.5).

667 *myzo vel sarcolabo haemorrhoides teneantur*—(11 30, p. 110).

668 In *Hippiatrica Berolinensia* we find four referent passages: 20.2.4 & 7 (choiras = goiter?), 20.7.8 & 11 (choiras), 88.5.3 (leeches in mouth), and 121.1.5 (kustis, a type of ulcer, especially rectal). *Labis* occurs twice: *Hippiat. Cantabrig.* 71.7.2 (snakebite); *Hippiat. Frag. Anat.*

Nineteen spring forceps have been recovered in one instrumentarium, that of the Domus 'del chirurgo' at Rimini. These vary in size and jaw shape. Most are reported as dentated, some not, and some have sliding catches. Two specimens are of the coudée type, while four, as noted above, make up a graded set featuring dentated hollow jaws, similar to those on the uvula forceps (see below). One specimen is of iron as opposed to the usual copper alloy.⁶⁶⁹ When one combines these with other forceps types (see below) found in the Rimini house, we realize how full the panoply of forceps could be in a full set of tools.

Eyelid Forceps

In Paul's treatment of trichiasis he observes that some surgeons do not dissect away the affected tissue on the interior of the eyelid; rather they cut away the redundant skin after raising it with "a forceps for holding down/gripping the eyelid." To this instrument Paul applies the term *blepharokatochon mudion*, which he describes as "shaped in accord with the surface of the eyelid."⁶⁷⁰ T. Meyer-Steineg concluded Paul had a special class of tool in mind and identified as the type a small forceps in his collection, allegedly from Ephesos. It featured a curved double-edged blade at one end and at the other a small forceps with jaws concave in profile.⁶⁷¹ Unfortunately, it is now lost. Paul may have had a specialty instrument in view but any small *labis/mudion* with reasonably broad jaws would be suitable, and one cannot exclude the possibility that he simply applied a fancy name to one such.⁶⁷²

Though only Paul mentions the name *blepharokatochon mudion*, it may have occurred in other sources as it makes its way onto *Lists*. So too the name ὀφθαλμοστάτης/*ophthalmostates*, which likely designates the same instrument.⁶⁷³

de bubis 12.4 (worms). The name *otolabis* (ear forceps) occurs once in *Hippiatrica Ber.* 99.1.7 (castration) and nowhere else. For *Lists* see Schoene (1903) 283; Bliquez (1987) 197; Fischer (1987) 35(17).

669 See Jackson's summary (2009b) 83 & 88.

670 τινές δὲ φεύγουσι τὴν ἀποδοράν, δι' ὃ μετὰ τὴν ὑποτομὴν βλεφαροκατόχῳ μυδίῳ τουτέστι πρὸς τὴν περιφέρειαν τοῦ βλεφάρου ἐσηματισμένῳ ἀνατείναντες τὸ περιττὸν δέρμα σμιλῶ ἀποκόπτουσιν... (6.8.2).

671 Künzl (1991a) 48(28) and (1991aa) 1 533(28).

672 E.g. Künzl (1983) 64–66, 76–77 and 90, 94, 120 where such forceps occur in conjunction with the small octagonally shaped handles and needle holders that are associated with eye work; see above Cutting and Puncturing Instruments, s.v. Suture Knife.

673 Schoene (1903) 281, 283; Bliquez (1983) 196, 198; Fischer (1987) 36(25 & 26). So also *Mulomedicina Chironis* 73 (*obtalmostatum*).

Tooth/Stump Forceps

The best description of any forceps type is Aristotle's construction of the ὀδοντάγρα/*odontagra* or 'tooth forceps' in *Mechanics* 854a16–32. Two salient features are ascribed to the instrument in this passage: (a) that the tooth forceps was composed of two levers on a pivot, and (b) that it was of iron.⁶⁷⁴

Only one surviving type of Greco-Roman forceps is regularly of iron. It also happens to consist of two elements on a pivot. Over 20 examples survive, many from readily identifiable surgical contexts.⁶⁷⁵ The seven recovered from the Domus 'del chirurgo' at Rimini represent the largest number from one site.⁶⁷⁶ Those that are well preserved have handles round or squared in section terminating at one end in globular or disclike swellings.⁶⁷⁷ At the other we find smooth, straight or incurved jaws/beaks that, seen from the side, are offset from the handles, as a bayonet (Fig. 65). The jaws of several specimens, feature a circular depression to grip the tooth (Fig. 49.14).⁶⁷⁸ Surely these instruments represent the forceps detailed by Aristotle.

In addition to tooth extraction,⁶⁷⁹ the *odontagra* was used in other operations. Soranus (*Gyn.* 4.11.5 Ilberg = 4.5.89 BGM) and Paul (6.74.3) use it to break up and remove the skull of an impacted embryo, and Paul again to extract bone fragments in cases of skull fracture (6.90.5) as well as imbedded weaponry (6.88.3 & 9). Aëtius even places cauterizing goat's dung on a diseased finger with the tooth forceps (12.1.214).

674 διὰ τί οἱ ἰατροὶ ῥᾶον ἐξαιροῦσι τοὺς ὀδόντας προσλαμβάνοντες βάρος τὴν ὀδοντάγραν ἢ τῇ χειρὶ μόνῃ ψιλῇ; πότερον διὰ τὸ μάλλον ἐξολισθαίνειν διὰ τῆς χειρὸς τὸν ὀδόντα ἢ ἐκ τῆς ὀδοντάγρας; ἢ μάλλον ὀλισθαίνει τῆς χειρὸς ὁ σίδηρος, καὶ οὐ περιλαμβάνει αὐτὸν κύκλῳ· μαλθακὴ γὰρ οὖσα ἢ σὰρξ τῶν δακτύλων καὶ προσμένει μάλλον καὶ περιαρμόττει. ἀλλ' ὅτι ἡ ὀδοντάγρα δύο μοχλοὶ εἰσιν ἀντικείμενοι, ἐν τὸ ὑπομόχλιον ἔχοντες τὴν σύναψιν τῆς θερμαστρίδος· τοῦ ῥᾶον οὖν κινήσαι χρῶνται (οἱ ἰατροὶ) τῷ ὀργάνῳ πρὸς τὴν ἐξάιρεσιν. (Description of the parts of the instrument follows).

675 For full catalogue and discussion of this forceps type against the background of modern types and their use, see the extensive treatment of Leonardo Dude (2005). Other sources to consult for illustration and discussion include: Künzl (1983a) 71 & 72 Wederath, 102 Mérida, 57 & 58 St. Privat d'Allier, 106 Luzzi, and 42 Kallion; (Künzl-Weber 1991) Gadara; and (Riethe [1989] 900–901) Germania Superior.

676 Jackson (2009b) 85 & 89.

677 Dude (2005) suggests that these globes or discs prevented the hand of the operator from slipping off of the handles; he also posits that the handles themselves might have been wrapped in cloth or leather to facilitate gripping; see esp. 96–97, 113–114.

678 Germania Superior (Riethe [1989] 900–901); Saalburg (Dude [2005] 95(77)).

679 Galen, *Comm. Hipp. Epid.* 6, 17a.91K = Wenkebach p. 68; Aëtius 2.168.18; Paul 6.28.

Celsus pulls teeth (7.12.1B–C) and extracts broken roots that may occur in the process (see below) with a *forfex*. If a fragment (*testa*) of a tooth is left, it should be probed for and then removed with a *volSELLa* (7.12.1D), clearly a smaller type. This passage, contrasting *forfex* and *volSELLa*, shows that *forfex/forceps* was generally the Latin term for heavy-duty pliers-like forceps. As to manipulation of the instrument, we learn from Celsus (7.12.1C) and Paul (6.28.1) that it could be used first to loosen the tooth little by little (τῇ τε ὀδοντάγρῃ κατὰ μικρὸν διασείσαντες ἐξελκύσομεν) and that it had to be pulled straight up at the moment of extraction (*recta vero forfex ducenda est*).

Like Paul, Celsus draws imbedded projectiles like barbed arrows (7.5.2B–C) and sling bullets (7.5.4-B) and plucks out fragments of bone in cases of fractured skull “with the forceps designed for the purpose” (*forfice ad id facta* 8.4.16). And, like Aëtius, Cassius Felix places a caustic plaster on a fistulous ulcer *forcipe/forpice* (19.4, readings vary, Rose preferring the former, Fraisse the latter).

The name *odontagra* occurs as early as the Hippocratic work *Physician* (9P), though without any useful details, and as late as *Lists* and the 12th century *Typikon*, or Monastic Foundation Document of the Pantocrator Monastery in Constantinople.⁶⁸⁰

In general there appears to have been great reluctance to pull a tooth. A passage in Caelius Aurelianus (*Chron. Diseases* 2.4.84) is relevant. After noting that Herophilus and Heracleides of Tarentum had recorded cases of death from tooth extraction, he adds that Erasistratus had seen a lead forceps in the temple of Apollo at Delphi, a reminder that only those teeth loose enough to be removed with an instrument as malleable as lead should be pulled. The Delphic forceps is called by the Greek name *odontagogon* in Caelius’ text. Clearly the *odontagogon* and the *odontagra* were identical instruments.

Caelius gives us another name for *odontagogon* when he translates the term into Latin as *dentiducum* (sc. *instrumentum*). Varro too gives another name, *dentharpaga*, for *odontagra*; but he does so in a Menippean satire. The satirical context and the fact that the name is a Greek-Latin hybridization (*dens* +

680 Schoene (1903) 282; Bliquez (1983) 201; Fischer (1987) 37(33). For the *Typikon* see Gautier (1974) 105 (lines 1270–80). For a translation of Gautier’s text: see Robert Jordan, “28. *Pantokrator: Typikon* of Emperor John II Komnenos for the Monastery of Christ *Pantokrator* in Constantinople,” in John Thomas and Angela Constantinides Hero, eds., *Byzantine Monastic Foundation Documents: A Complete Translation of the Surviving Founders’ Typika and Testaments*, Vol. 2 (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2000), no. 28, pp. 725–781. The list of tools (p. 764 [§ 52]) includes “lancets, cauterizing irons, a catheter, forceps for drawing teeth . . .”

ἄρπαξ) may mean that this term was made up as a joke and was never used by physicians.⁶⁸¹

Celsus offers the lengthiest description of the process of tooth extraction and the risks involved (7.12.1-F). He recommends that the tooth be separated from the gum and shaken loose prior to extraction with fingers or forceps.⁶⁸² If it is badly decayed, it should be packed with lint or lead. If during extraction the bone under the gum is broken, one has to probe for it and remove it with a small forceps (*volSELLA*). If a root is left behind it must be removed with a special forceps (*forfice*) which Celsus says the Greeks call ῥιζάγρα/*rhizagra* ('stump' or 'root forceps').⁶⁸³ Ironically no surviving Greek literary source connects the *rhizagra* with teeth. Instead Aëtius (16.23.45) substitutes the *rhizagra* for the *odontagra* in extracting the crushed skull of an impacted embryo, and Paul mentions the same instrument simultaneously with the *odontagra* in removal of imbedded weaponry (6.88.3 & 9). As they seem so interchangeable, it is hard to see how the two forceps are distinct. We must have here two names for the same instrument.

This is one of the rare instances in which we have an actual depiction of an instrument in use. In the House of Siricius in Pompeii there was a painting of the episode in Aeneid 12.404 showing Iapyx attempting to extract an arrow-head from the wounded thigh of Aeneas *tenaci forcipe* (Fig. 95).⁶⁸⁴

It will be observed that regarding this and the following two types (bone and weapons forceps) the sources sometimes record that a procedure might be performed with any of them. This makes it likely that we are again sometimes dealing (a) with multiple names for the same instrument and (b) that a particular forceps could probably be called a bone, tooth or weapons forceps, depending on how it got used.

Bone (Sequestrum) Forceps

In dealing with skull fracture Galen creates access for the lenticular by bending back or breaking off bone fragments with an ὀστέγρα/*ostagra* or bone

681 Varro, Men. 441.1 = Nonius Marcellus 99M. For the characteristics of Verrine Satire see M. Coffey, *Roman Satire* (London, Methuen, New York, Barnes and Noble, 1976), 149–164.

682 So too Aristotle, *Mechanics* 854a 30–31: ὅταν δὲ κινήσῃ (the operator), ἐξείλε ῥᾶον τῇ χειρὶ ἢ τῷ ὀργάνῳ.

683 *ad id facta forfice quam rizagran Graeci vocant* (7.12.1F).

684 The same phrase is used of the heavy-duty tongs employed by Cyclopes at their Aetna forge (Vergil, *Georgics* 4.175). For the painting in the House of Siricus (VII 1.25 & 47), now in the Naples Museum, see Scarborough (1969) Pl. 18. Note that in the painting the forceps is colored white, not golden, as if to depict an iron/steel model.

forceps (*Meth. Healing* 10.449K = J-H 2.226–227; copied by Oribasius, *Coll. Med.* 46.21.25). Paul removes fragments of fractured skull with the same instrument (6.90.5). The *ostagra* is also deployed by Oribasius to grip bone in treatment of other fractures (*Coll. Med.* 46.11.26) as well as in excision of a rib (*Coll. Med.* 44.8.7). Soranus (*Gyn.* 4.11.5 Ilberg = 4.5.89 BGM), Aëtius (16.23.45 [Philumenus]) and Paul (6.74.3) all mention its use in crushing and removing the skull of an impacted embryo. It will be remembered that Hippocratics performed this operation by crushing the baby's skull with a cranioclast and then removing the fragments with an ὀστεολόγον/*osteologon*, which can only be an earlier name for the *ostagra* (*Diseases of Women* 8.70.5L).⁶⁸⁵ In addition to *ostagra* the name ὀσταναλαβέως/*ostanalabeus* (perhaps originally ὀσταναλαβίς) appears on *Lists*.⁶⁸⁶ This term, too, must be yet another name for the instrument. I have previously argued that the *ostagra* like the *odontagra* must have been present among the instruments kept in establishments like the Pantokrator Monastery.⁶⁸⁷ If so, its actual use (as opposed to its mere presence on *Lists*) and, by extension, the use of other instruments for the skeleton, continued from the 5th century well into Byzantine times.

The kind of bone work described in these sources requires a sturdy pliers-like instrument. Note that the *ostagra* is coupled in the literary testimonia with the *odontagra*/*rhizagra*, which is of precisely this construction (see immediately above). Solid serrated or dentated jaws would also be desirable. A number of surviving pliers-like forceps of copper alloy have these features. Three, from Pompeii, Luzzi and now Rimini respectively, feature jaws that curve off together in the same direction (Fig. 1, middle row, 4th from left; Fig. 49.16; Fig. 64); two, from Rimini and Colophon have jaws that come evenly together, as do the jaws of a modern pliers (Fig. 49.15; Fig. 63). The Domus 'del chirurgo' at Rimini now supplies three more, one with straight jaws, two resembling those at Pompeii and Luzzi.⁶⁸⁸

685 Though the term ὀστεολόγον is not found after Hippocrates, the verb ὀστεολογέω and the noun ὀστεολογία are found as late as Pseudo-Galen (*Intro. or Physician* 14.690 and 720K = Petit 7.2 & 12.1).

686 Schoene (1903) 282; Bliquez (1983) 196, 201; Fischer (1987) 31–32, 35–6.

687 Bliquez (1999) 315.

688 For Pompeii, see Bliquez, Jackson (1994) 171(242); for (Luzzi) see Künzl (1983a) 106(85.2); for Potaissa Turda see Künzl/Weber (1991) 107; for Colophon see Caton (1914) 115, Pl. x; and for Rimini see Jackson (2009b) 83 & 88. A pliers-like instrument of the third century CE with bowed jaws can also be cited, as it may have served as a surgical forceps. This item was recovered from a grave in Frénouville, France, and is now in the Musée de Normandie, Caen; see L. Buchet, C. Pilet, "À propos de quelques exemples de pratiques

Missile Forceps

In removing impacted missiles Paul makes the extraction “with a tooth forceps or root forceps or a missile forceps (*beloulkos*) or some other suitable tool” (δὲ ὀδοντάγρας ἢ ριζάγρας ἢ βελουλκοῦ ἢ ἑτέρου τινὸς ὄργάνου προσφόρου 6.88.3). As the similar sounding *embruoulkos* was a type of hook, the *beloulkos* by analogy might also have assumed a hooked shape, or even a shape akin to the spoon-like Scoop of Diocles (see s.v. under Probes). However, a well known painting from the House of Siricius in Pompeii showing Iapyx extracting an arrow-head from the thigh of Aeneas, a scene from Vergil’s *Aeneid* (12.404), depicts a sturdy pliers-like forceps closely resembling the tooth and bone types discussed immediately above (Fig. 95).⁶⁸⁹ This painting and the mention of these instruments by Paul in conjunction make it likely that a bone forceps or a tooth forceps is what Paul means by *beloulkos*.

Fire Tongs

Galen once uses fire tongs as a sturdy forceps (πυράγρα/*puragra*) to grasp the heart in vivisectioning the thorax of an animal (*Anat. Proc.* 2.635K).

Uvula Forceps

The Hippocratics and Celsus attest partial amputation of an inflamed uvula.⁶⁹⁰ The instruments used are simply a forceps to put the uvula on the stretch and a scalpel to sever the selected portion. But in Imperial Greek sources we hear, in addition, of an instrument called σταφυλάγρα/*staphulagra*. With this Aëtius (8.44.7–14) and Paul (6.31.2) strangle the uvula prior to cutting, thereby reducing the loss of blood.⁶⁹¹ The latter also finds the *staphulagra* useful in gripping for excision the callous around a divided anal fistula (6.78.2), and, as in

médicales et chirurgicales en Basse-Normandie pendant le Moyen Âge,” *Archéologie Médiévale*, 14 (1984), 61–76, esp. p. 65 and Fig. 4.

689 For other musings on *beloulkia* in an epic context, see also Porphyrius of Tyre, *Quaestionum Homericarum ad Iliadem pertinentium reliquiae* 11.843.1–2 and Eustathius, *Commentarii ad Homeri Iliadem pertinentes* 3.338.9.

690 [Hippocrates], *Diseases* 2.29P; Celsus, 7.12.3. Uvulectomy is now regarded as obsolete. In addition to amputation, Hippocratics also simply lanced inflamed uvula: *Diseases* 2.10P.

691 Aëtius reads: πρὸς δὲ τὴν χειρουργίαν καθέδριος ὁ πάσχων σχηματιζέσθω πρὸς αὐγὴν λαμπράν καὶ τότε διαστελλέσθω τὸ στόμα, ἔπειτα τῷ μυδίῳ ἀποτεινέσθω ἐρείδοντες τὴν σταφυλάγραν κατὰ τὸ μεσώτατον αὐτῆς ἢ μᾶλλον ἐξωτέρῳ καὶ ἀποταθείσα ἐπιστρεφέσθω τῇ γὰρ ἐπιστροφῇ ὥς ἂν εἴῃ ἀποβρεχιζομένη γρυπούται πελιοῦται, γίγνεται δυσαιμορράγητος καὶ διὰ τοῦτο ἐπιμένειν χρή ἐπὶ τινὰ χρόνον κατέχοντα ἐφ’ ὅσον ὁ πάσχων μὴ δυσανασχετῇ καὶ τότε ἀφαιρεῖν μὴ ἄνωτέρῳ τοῦ μυδίου, ἀλλὰ πρὸς τῇ βάσει αὐτοῦ.

uvulectomy, he reports that the famous Leonides strangles hemorrhoids with the *staphulagra* prior to excising them with a scalpel (6.79.1).

The association with the uvula (*staphule* in Greek) obviously accounts for the name *staphulagra*. It also bore other names beginning with *saphul-*. Aëtius (in some text unknown to us apparently) also called the instrument *σταφυλοκάτοχον* (*staphulokatochon*).⁶⁹² Someone else must have termed it *σταφυλολαβίς*/*staphulolabis*; for this, and only this, is the name that is entered on *Lists*,⁶⁹³ and it can hardly designate anything else than a uvula forceps.⁶⁹⁴

Unfortunately, no source says anything about the form assumed by the *staphulagra*. Clearly the tool was a type of forceps if it was used to crush the uvula and grip hemorrhoids, not to mention that compound names in *-αγρα* and *-λαβίς* suit a forceps perfectly. The uvula forceps must have had long handles if it had to reach the back of the throat; likewise dentated jaws will have been desirable for gripping. That the *staphulagra* had serrated or dentated jaws is clear, both from the operations for which it was applied and from Paul's coupling of it with the *mudion*, which regularly had this feature.⁶⁹⁵ Approximately 20 surviving cross-legged forceps types answer to these specifications (Fig. 11.12 illustrates the basic form taken). Of these, two were recovered in the instrumentarium of the 'Surgeon of Paris' and, more recently, a pair in the Domus 'del chirurgo' at Rimini and another pair at Alliano; so there is no doubt that the type was used in surgical operations.⁶⁹⁶ Since this forceps is perfectly suited for the operations performed by the *staphulagra* and, since *staphulagra* is the only name that has not been applied to other well-attested forceps types, it is reasonable to suppose that this particular model is the *staphulagra* mentioned in the literature. Jackson, who is of this view, has compiled a catalogue of the

692 In J.G. Schneider, *Nicandri Alexipharmaka seu De venenis in potu cibove homini datis eorumque remediis carmen* (Halle, 1792) ad 511 (p. 243). The name goes well with Paul's directive that the uvula should be 'pulled down' (πρὸς τὸ κάτω μέρος ἔλξαντες ἀποκόψομεν...) before excision.

693 Schoene (1903) 283; Bliquez (1984) 197. The name also appears in garbled form in the *Liber Esculapii de Morbis Chronicis*: see Fischer (2012) 50.

694 The Liddell-Scott Greek Lexicon equates the *σταφυλεπάρτης*/*staphulepartes*, an instrument mentioned once by Paul, with the *staphylagra*. However, the *staphulepartes* was likely a spoon: see Probes, s.v. Spoon (?) for Application of Gargle to Uvula.

695 6.31.2, 6.78.2: *σταφυλάγρᾳ ἢ μυδίῳ*.

696 For the two forceps in the Paris instrumentarium, see Künzl, (1983a) 76(50.15–16); for those in Rimini see Jackson (2003) 320 and (2009b) 85 & 89; for those (only the jaws in one case, but the first example in iron) recovered at Alliano see Baykan (2012) cover, 144–145(294–295) & 205 Fig. 16. Baykan also claims these instruments were heated based on wooden grips found with them.

staphulagra along with four hybrid specimens in his thorough discussion of uvulectomy in the Greco-Roman world.⁶⁹⁷ He divides the recovered specimens into two types: one with straight legs more useful for work in the throat and one with bowed legs more suitable for hemorrhoidectomy. Lately, he has also published a remarkably efficient variant, now in the Ashmolean Museum.⁶⁹⁸ This specimen features the usual dentated spoon-shaped jaws, but its legs are arranged like those of a spring forceps. Also like a spring forceps the legs can be opened/closed by a sliding catch; however, this catch is not guided manually but is raised or lowered by a final mounted plunger passing through the uppermost point at which the legs meet (Fig. 66; compare also Fig. 11.10). This makes it handier for use in closed spaces than the usual two-piece pliers-like model.

Some specimens of *staphulagra* have jaws pierced with a hole (Fig. 2, middle row, 9th from rt.). Though Milne considered this refinement useful for clamping the jaws in position with a cord, etc., that would have been much easier to accomplish with, say, a sliding ring. It is therefore unclear what purpose this hole may have served.

If we are correct in our identification of the *staphulagra*, it is easy to envisage more functions for it than those attested in the literature; for example, it looks well suited for extraction of missiles like sling bullets or arrowheads. Note that in addition to the tooth, stump and missile forceps, Paul allows for other suitable instruments (δι' ὀδοντάγρας ἢ ριζάγρας ἢ βελουλκοῦ ἢ ἑτέρου τινὸς ὀργάνου προσφόρου 6.88.3).

While the *odontagra* and the *staphulagra* are mentioned in passing in the Hippocratic treatise *Physician* (9P), the date of this work is uncertain. Paul's association of Leonides with the *staphulagra* firmly places it in the first or early second century of our era at the latest.

Hemostat?

Among the instruments recovered at Alliano, was found a tool identified by its excavator as a hemostat (Baykan [2012] 145 Kat. Nu. 297). It consists of two handles revolving on a pivot at the point where the handles morph into jaws (Fig. 67). The latter on their interior are smooth and flattened. Of the handles one is broken off but it was clearly straight; the other, complete, is bowed and terminates in a squarish element that is flanged so as to accept and hold in position the missing terminal end of its straight partner. Such an instrument

697 Jackson (1992) plus (2003) 320; Krämer (2000) 79–80. Three specimens in the Meyer-Steineg Collection should be viewed with caution: Künzl (1991a) 58(57), 60(63–64) & (1991aa) I 538(57) and II 190(63–64).

698 Jackson (1997b).

is well suited for clamping a blood vessel and the few parallels known to date have been so identified. Thier identification has been disputed because none has been securely placed in a surgical context.⁶⁹⁹ The present piece, however, is said to have been found along with a saw “outside of the structure” clearly connected with medical activity at Alliano (Baykan [2012] 165). If so, surgical context may no longer be an issue, at least in this rare case.

Bothersome is a dearth of testimonia to use of a forceps as a hemostat. Other than references connected with the uvula forceps (see above), I find only one instance in the garbelled Latin of *Mulomedicina Chironis* 102 where the standard term *sarcolabis* is used (*venam ipsam . . . sarcolabida comprehendes, ita ut sanguis praeccludatur*).⁷⁰⁰ The dearth of references and the fact that other models might fill this function just as well,⁷⁰¹ might account for the absence of a special name for a forceps used in this way.

Caustic Forceps

Caustic medicines are not infrequently cited in the literature for the treatment of various conditions. One such is inflamed uvula, when an alternative to amputation is preferred because the patient is timid or there is fear of hemorrhage. In these cases Paul recommends application of a caustic substance by means of an instrument he terms *σταφυλοκαύστης* (*staphulokaustes*).⁷⁰² Again, in dealing with hemorrhoids he tells us that, besides strangling them by ligature or with the *staphulagra*, “others used to burn hemorrhoids, as the uvula, by filling the hollows of the *staphulokaustes* with a caustic medicine (6.79.1).”⁷⁰³ In using the past tense Paul seems to indicate his disapproval of the latter method. The same chapter also attests use of the *αίμορροϊδοκαύστης* (*haimorrhoidokaustes*) or *staphulokaustes* for strangling piles in conjunction with ligation.⁷⁰⁴ I see no good reason to doubt that *haimorrhoidokaustes* was an alternate term for *staphulokaustes*.

699 Künzl 1998 esp. 78 nn. 10 & 11.

700 Majno (1975) 362–365 plausibly suggests a forceps lies behind Celsus 5.26.21C (*venae . . . adprehendendae*), but a sharp hook might just as well be meant.

701 (E.g. Fig. 2, bottom row, 13th from left; Fig. 3, middle row, 9th from rt.; Fig. 11.10).

702 6.79.1. The mss. mainly transmit *σταφυλοκαύστης*, but the variant *σταφυλοκαύστης* is the one to survive on *Lists* and is preferred in scholarly discussion. For *Lists* see Schoene (1903) 283; Bliquez (1983) 203; Fischer (1987) 39(58).

703 ἕτεροι δὲ τὰς κοιλίας τοῦ σταφυλοκαύστου πληρώσαντες τοῦ καυστικοῦ φαρμάκου, καθάπερ τὴν σταφυλὴν, οὕτω καὶ τὰς αἰμορροΐδας ἔκαιον.

704 As not all manuscripts transmit these terms, they are rejected by some authorities. For the difficulties see Milne (1907) 99. Heiberg’s edition, which does accept them, reads: εἰ μὲν ἀποσφίγγει κεκρήμεθα, λίνον πεντάπλοκον τῷ αἰμορροΐδοκαύστη ἢ τῷ σταφυλοκαύστη πρὸς τὰ

From Paul then we gain the impression of a forceps with deep spoon shaped jaws closing evenly on one another.⁷⁰⁵ A crosslegged forceps with Paul's stipulations survives in limited quantity: one example each in Vienna, Bristol, Marcianopolis (Devnja, Bulgaria), and Rimini (Fig. 11.13).⁷⁰⁶ Treating the uvula in this way must have been uncomfortable and risky. For the operation to be successful, Paul tells us the patient had to gape wide and bend forward for a full hour. Furthermore, special care had to be taken that none of the caustic medication escaped; hence swallowing (not to mention gagging!) was precluded.

The ninth century Byzantine authority Leon Iatrosophistes (*Consp. Med.* 4.8.3) amputates inflamed and gangrenous uvula (σταφυλοτομία), or he removes it "with a cold cautery" (ψυχρῷ καυτηρί). It is quite likely that by 'cold cautery' Leon means the *staphulokaustes*, an instrument designed specifically for the uvula and one that burns it away without fire. The *staphulokaustes* or *staphulepartes* (see ss.vv. under Probes, etc.) may also lie behind the activities of Fannius, a surgeon mentioned by Martial: "he cures an inflamed uvula without cutting."⁷⁰⁷

χειλή περιθέντες ἐκάστην αἰμορροΐδα διὰ τούτου τοῦ βρόχου ἀποσφίγγομεν . . . Milne translates in part: "By means of the forceps for applying caustic to haemorrhoids, or the forceps for applying caustic to the uvula, we surround them close to the jaws of the instrument with a five-ply thread of lint, and strangle the haemorrhoids separately with this ligature." He also envisages two instruments differing only in the lengths of their handles, but this seems a too subtle distinction.

705 δεῖ τοίνυν τὸ ἐν τῇ καύσει τῶν βλεφάρων εἰρημένον ἢ ἕτερον τοιοῦτότροπον λαβόντα καυστικὸν φάρμακον πληρῶσαι τούτου τοῦ σταφυλιοκαύστου τὰς κοιλότητας . . . 6.31.2.

706 For Vienna, see Milne, *Instruments*, Pl. XXXII, 2. The specimen in the Fawcett collection of the Bristol City Museum has been published by Ralph Jackson (1992). For Rimini see Jackson (2009b) 85, 89. A. Minchev (1983) 145 claims a third example from Devnja. This is not included in the republication of this material by Kirova (2002), but E. Künzl has shared with me a photo provided him by Minchev in which it appears clearly enough. At Alliano there has appeared what would be taken as yet another specimen were it not for the fact that the jaws apparently form at their apex an open cylinder (see Baykan [2012] cover, 145(296) & 205 Fig. 17 = Fig. 94). The piece has been interpreted as an anal speculum by its excavator. If so, it deviates significantly from the standard type (see below). It seems to me a forceps but I am unsure what purpose it served. Jackson tells me that he has seen a similar type in the Wellcome Collection. The Alliano and Bristol instruments have handles richly decorated with acanthus molding and, in the case of the latter, lion's head finials.

707 *non secat et tollit stillantem Fannius uvam* (10.56.5). References to substances used as caustics are found as early as the Hippocratic *Art* (8).

Pharyngeal Forceps

Aëtius (8.53.9) gives directions for removing spines or fish bones stuck in the throat with an ordinary epilation tweezers (τριχολαβίῳ). Paul paraphrases Aëtius but substitutes the name ἀκανθοβόλος/*akanthobolos* for *tricholabion* (6.32.1).⁷⁰⁸ Paul may only be giving a fancy name to the epilation tweezers, but his language, “with the instruments specially termed fish-bone/thorn forceps” (τοῖς ἰδίῳς ἀκανθοβόλοις προσαγορευομένοις) strongly suggests that he has a special tool in mind. The name ἀκανθολαβίς/*akantholabis* entered in the *Corpus Glossariorum Latinorum* (II 212; VII 447) surely designates the same instrument and points further to the existence of a special forceps.⁷⁰⁹

On his visit to the Museo Reale di Portici in 1819 the Russian physician, Pyotor Savenko, sketched an angled forceps that is well suited for the operation Paul has in mind (Fig. 68).⁷¹⁰ This instrument seems to have disappeared, but there is a parallel piece in the Museo Archeologico Nazionale, Rome (Inv. no. 7726).

In any case the paucity of testimonia and the dubious nature of the archaeological remains are evidence that the *akanthobolos*, if a special forceps, was not widely used.

Forceps for Stone

Clearly a forceps might be used in removal of bladder stone; e.g., Aëtius uses one for plucking stone from the tip of the urethra (11.5.92: στενῇ λαβίδι). One might see an attractive candidate in the fine dentated model with jaws angled to one side included in a set of instruments weighted toward lithotomy. This is now preserved in the Cambridge Museum of Classical Archeology (Künzl

708 The last element of the name *-bolos* is unique for a forceps. Elsewhere we find it in terms used in the sense of ‘pry out’, as Paul 6.88.9: δεῖ δὲ ταῦτα მოკლესანთა დი’ ἀναβολέων ἢ κυαθίσκου τραυματικῆς μηλωτίδος ἀναβάλλειν. On that account Briau (1855), emended to ἀκανθολάβος/*akantholabos* (accepted by LSJ) in agreement with other forceps names terminating in *-labos/labon* (from λαμβάνω, ‘to seize/grasp’), e.g. *sarkolabos*, *tricholabon*, etc. This fits well with ἀκανθολαβίς, the other name for the instrument which survives as a gloss.

709 Plurarch provides an actual account of surgery to remove a fishbone from the throat of his townsman Niger (*Moralia* 130F–131A). In this case an incision was necessary to make the extraction. A forceps was likely used but no mention is made of one. The patient did not survive. See Renehan (2000).

710 For Savenko’s drawing see Bliquez, Jackson (1994) Pl. IV, F.14. The same drawing was reproduced by Védrenes (1876) Pl. x (5) and Milne (1907) XXXII (1), whose assessment can be found on p. 100.

[1983b] Taf. 63.1). The question is, did such a forceps have a special name? Apparently not. See above: Retractors and Hooks, s.v. Lithotomy Hook.

Forceps for Polyp

The argument here parallels the entry immediately above. Galen, *Cmpds. by Place*, 12.687K mentions in passing removal of nasal polyp with a small forceps (λαβιδίῳ ἐξαίρει). But again there seems not to be a specific name for this *labidion* or for another type of forceps that might have been so deployed. See above: Cutting/Puncturing Instruments, s.v. Polyp Knife.

Oddments

Lists transmit the name *μασχαλολαβεύς/mascalolabeus*. A forceps for gripping the armpit (*μασχηάλη*) seems pointless. Perhaps the name designated an instrument of reduction to support the armpit, as did ὑπερον and ἄμβη; cf. Bliquez (1984) 196.

Hippiatrica Ber. 99.1.7 attests an ὠτολαβίς/*otolabis*, or a veterinary forceps for ear-work. But in its sole mention it is used for castration.⁷¹¹

Gynecological and Obstetrical Instruments

Small (Rectal) Speculum

In dealing with fistula and hemorrhoids the Hippocratics dilated the rectum with a device called *katopter*. By the early Empire such a dilator bore the Greek name ἑδροδιαστολεύς (*hedrodiastoleus*) or μικρὸν διόπτριον (*mikron dioptrion*). Galen equated *hedrodiastoleus* and *katopter*,⁷¹² but the precise nature of the latter is unclear (see below). That the *hedrodiastoleus* and *mikron dioptrion* functioned as specula is clear from the sources cited by Oribasius and Paul in their respective treatments of anal fistula: Antyllus and Heliodorus in the case of Oribasius (*Coll. Med.* 44.20.66) and Leonides in the case of Paul (6.78.4).⁷¹³

711 κατακλίνοντα τὸν ἵππον καὶ καταλαβόμενον τοὺς πόδας, ἐκλαμβάνειν τοὺς ὄρχεις ἴσους καὶ ἀποδεσμεῖν τῇ ὠτολαβίδι.

712 *Hippocratic Glossary* 19.110K: κατοπτῆρι· τῷ κσλουμένῳ ἑδροδιαστολεῖ, ὥσπερ γε καὶ διόπτρα ὁ γυναικῶν διαστολεύς.

713 The passages are identical. Clearly Paul copies Oribasius but it is not clear who among Antyllus, Heliodorus and Leonides has copied whom. At any rate the citation from Paul reads: περὶ δὲ τῶν κρυπτῶν συρίγγων ὁ μὲν Λεωνίδης ταυτὶ φησιν· ὅταν δὲ βαθεῖα (sc. σύριγξ) τυγχάνῃ τὸν σφιγκτήρα σεσυριγγωκυῖα ἤτοι ἀπὸ τοῦ δακτυλίου ἀρξαμένη καὶ ἐπὶ πολὺ κεχωρηκυῖα ἢ ἐν τῷ σφιγκτήρι κατεσκευασμένη, μετὰ τὴν δεδηλωμένην σημείωσιν τῷ ἑδροδιαστολεῖ (τῷ μικρῷ διοπτρίῳ λέγω) διαστεῖλαι τὴν ἔδραν ὡς γυναικεῖον κόλπον: Later in

All these noted practitioners worked in the first or second centuries. To quote Leonides:

When a deep fistula occurs in the sphincter, whether originating in the anus and spreading extensively or being established in the sphincter itself, after the examination I have described, dilate the rectum with the *hedrodiastoleus* (I mean the small speculum [*mikron diopttron*]) as we do the female vagina.

A surviving apparatus consisting of two elements featuring projecting valves and rotating on a pivot has long been seen as the speculum in question (Fig. 1, middle row and Fig. 73). Altogether eleven specimens survive.⁷¹⁴ While no classical source, with perhaps the exception of Celsus (see below), ever describes the instrument, the fact that it is termed μικρόν or ‘small’ distinguishes it from the much larger, but similarly valved, uterine speculum. This fact and the astonishing resemblance of classical survivals to modern versions of the rectal speculum make the identification certain.⁷¹⁵ The device was operated like a forceps of the pliers type by compression of its handles, which action forced the valves apart. One drawback to the rectal dilator experienced by Paul in his own practice was that the valves of the device might on occasion conceal the mouth of a fistula.⁷¹⁶

This type of speculum may also have been useful for dilation of the female organs.⁷¹⁷ Oribasius and Paul both tell us, “to dilate the rectum with the *hedrodiastoleus* . . . as we do the vagina.” These words need only refer to the act of dilation, not necessarily to dilation of the vagina with the same tool. On the other hand they certainly admit of that interpretation; furthermore, it is noteworthy that one of the Pompeian specimens was recovered in the Casa del Medico Nuovo (II), where a uterine speculum, a birthing hook, and a female

the passage Paul abbreviates ἑδροδιαστολεύς to διαστολεύς. The name ἀντόπτρα on *Lists* might also refer to this instrument if it does not mean a uterine speculum; see Bliquez (1984) 195.

714 To the list drawn up by Jackson (1991) Table 1, add a specimen in the Deutsches Klingenmuseum, Solingen (unpublished; provenience unknown, inv. 74, B24.) and one from Valeria: Fuentes Dominguez (1987) 255 and Fig. 4(1 & 5).

715 See for example the rectal specula advertised in *Catalogue of Surgical Instruments of Superior Quality*, Biddle and Crowther Inc. 321 Seneca St., Seattle, WA. 1935 (24th ed.), 58.

716 τούτῳ μὲν τῷ τρόπῳ χειρουργίας οὐκ ἡδυνήθημεν χρῆσασθαι διὰ τὸ μὴ ὑποπίπτειν τῇ ὁράσει τὴν ὑποφορὰν τῆς σύριγγος· μεταξὺ γὰρ ἦν δακτυλίου τε καὶ σφιγκτήρος κατὰ τὸ δεξιὸν τεταγμένη μέρος, καὶ ὁ διαστολεύς μᾶλλον ἐπεσκότει τῇ ἐνεργείᾳ.

717 So also Milne (1907) 150 and Longfield-Jones (1986) 82 note 9.

clyster were also found.⁷¹⁸ Clearly this was a site where gynecology was practiced. The practitioner in the Casa del Medico Nuovo (11) may very well have found his *hedrodiastoleus* or *mikron diopttrion* more appropriate for some women or girls, depending on the situation.

In addition to rectal and, possibly, vaginal examinations and operations, the instrument may also have been used in treating wounds. Celsus (7.5.2B) remarks on an instrument used in extraction of impacted arrowheads. He gains access to the missile by dilating the wound with a device that he compares to a letter of the Greek alphabet (*ferramento ad similitudinem facto Graecae litterae*). Unfortunately the figure of the letter has dropped out of the text. However, it is likely that the Greek letter in question was upsilon (Υ).⁷¹⁹ The shape assumed by the small dilator when its valves are open and its handles completely compressed is exactly the configuration of upper case upsilon.

All surviving specimens are of course of Roman Imperial date. The fact that Celsus only describes but does not name the instrument has prompted Jackson to suggest that it may only have been recently developed, at least in the form assumed by the surviving examples.⁷²⁰ If so, the Hippocratic *katopter* may only have been two large spoons (see s.v. *Speculum?* in the chapter on Hippocratic Surgeries and Surgical Tools).

For oral dilators, see below Miscellaneous Parasurgical Items, s.v. *Wedge*.

Large (Uterine) Speculum

The *Hippocratic Corpus* mentions only the use of probes and probe-like dilators, graduated in size, for accessing the womb. We first encounter an instrument designed specifically as a vaginal/uterine speculum in Soranus. The relevant chapter (περὶ διοπτρισμοῦ) is now missing from the manuscripts, but Muscio's Latin paraphrase exists (II 34, pp. 117–119).⁷²¹ It shows clearly that the instrument, which he calls *organum/on* but says the Greeks call *dioptra*

718 Bliquez, Jackson (1994) 65–6, 84–85; Bliquez (1995) esp. 212–214.

719 So Spencer in his Loeb edition (vol. 3, p. 316); also Majno (1975) 359, Döderlein (1977) 18, and Jackson (1991) 105–106.

720 Jackson (1991).

721 *Scio me retro ad inspiciendum altitudinem mulieris frequentius organi mentionem fecisse quod graecitas dioptran vocat...* (After the patient is properly positioned) *Deinde accepto organo et uncto priapisco, quem Graeci loton dicunt in aliquantum ad prunes calefacere <debes>, deinde sine quassatione priapiscum inicere, susum scilicet axe posito, iubere etiam ministro ut aperiendo organo axem torquere incipiat, ut paulatim partes ipsae aperiantur. Cum vero post visum organum tollere volueris, ministro iubere ut iterum axem torqueat quo organum claudi possit, ita tamen ut cum adhuc in aliquantum patet sic auferatur, ne uniuersa clusura aliquas teneat et nocere incipiat.*

(δίοπτρα), consisted of a valved mechanism, the *priapiscus* (πριαπίσκος) or *lotos* (λωτός), and that this was opened by a screw or worm called in Latin *axis*. Aëtius's chapter on uterine abscess, copied by Paul 6.73.1–2 (cf. also 3.65.1) details the same parts, with the added information that the screw in Greek was called *kochlia/kochlios* (κοχλία/κοχλίας) and that the individual valves making up the *lotos* were called *elasmata* (ἐλάσματα).⁷²² Aëtius, being more succinct, is worth quoting in full:

Let the operator perform the examination with a speculum appropriate to the age of the patient while sitting to her right. Before the examination he needs to measure the depth of the vagina with a probe to avoid unduly pressuring the uterus if the *priapiscus* is too long. If the *priapiscus* is found to be too long, let pads be placed along her labia so the speculum can be worked (while supported) on them. Next the *priapiscus* has to be inserted with the worm/screw pointed up and the speculum controlled by the operator, the worm being turned by the assistant, so that the vagina is dilated as the valves separate (16.89.1–18).⁷²³

Muscio adds that the *priapiscus* was lubricated with oil and warmed over coals before being introduced.

As Muscio states, surviving literary sources in Greek commonly use the name *dioptra* to identify the uterine speculum. The term, 'small speculum' (μικρὸν διόπτριον) was used to distinguish the rectal speculum (see above) from the larger uterine model. Still other names for the uterine type may have been in circulation. In Galen's *Hippocratic Glossary* we find the *dioptra* defined as ὁ γυναικῶν διαστολεύς (19.110K), which may mean the name *diastoleus* was used. In addition to *dioptra* the terms διαστολεύς, ἀντόπτρα and μητρανύκτης occur on *Lists* (the latter two only there), but it is unclear whether they refer to a

⁷²² For the *kochlios* see also Tertullian, *De Anima* 25.5 (where it is rendered *tortili temperamento*).

⁷²³ ὁ δὲ ἐνεργῶν ἐκ τῶν δεξιῶν μερῶν καθεζόμενος διοπτρίζετω <τῇ πρὸς ἡλικίαν καταλλήλῳ διόπτρᾳ>. δεῖ δὲ πρὸ τοῦ διοπτρίζειν <ἀναμετρεῖσθαι διὰ μήλης τὸ τοῦ γυναικείου κόλπου βάθος>, ἵνα μὴ μείζονος ὄντος τοῦ τῆς διόπτρας λωτοῦ συμβαίνει θλίβεσθαι τὴν ὑστέραν, καὶ εὐρεθέντος τοῦ κόλπου μείζονος τοῦ λωτοῦ, πτύγματα ἐπιτιθέσθω κατὰ τῶν πτερυγωμάτων, ἵνα κατ' αὐτῶν ἡ διόπτρα ἐργάζεται. δεῖ δὲ καθιέναι τὸν <λωτὸν> τῆς <διόπτρας> εἰς τὸ <ἄνω μέρος> τὸν <κοχλίαν> ἔχοντα, καὶ <κρατεῖσθαι> μὲν τὴν <διόπτραν> ὑπὸ τοῦ <ἐνεργοῦντος, στρέφεσθαι> δὲ <τὸν κοχλίαν> διὰ τοῦ <ύπηρέτου>, ἵνα <διίσταμένων> τῶν τοῦ <λωτοῦ ἐλασμάτων> διασταλῇ ὁ κόλπος.

speculum or to a probe-like dilator.⁷²⁴ When Milne finds the term *speculum* in 'late' Latin, he surely means Renaissance Latin.⁷²⁵ Speculum does not occur in classical authors in the contemporary sense of vaginal dilator.

With one exception, surviving Greco-Roman uterine specula are trivalve models. Their close resemblance to descriptive language in the written sources and to the Renaissance type associated with Jacob Rueff insures their proper identification.⁷²⁶ In 1818 the first specimen to be excavated was found in Pompeii at a location on the Via dell' Abbondanza that has come to be known as the House of the Medicus A. Pumponius Magonianus = VIII 3.10–12 (Fig. 1, middle row, 3rd from rt. and Fig. 71). This remarkable discovery was followed by the recovery in Pompeii of two more such instruments, a still unique quadri-valve in 1882 (Fig. 1, middle row, 2nd from rt. and Fig. 70a–c), probably in the Casa del Medico Nuovo (I) = VIII 5.24, and another trivalve in 1887 in the Casa del Medico Nuovo (II) = IX 9.3–5 (Fig. 1, middle row, 1st on rt. and Fig. 72).⁷²⁷ The trivalve of 1887 was found along with a rectal speculum, an embryo hook (see below) and a uterine clyster (see s.v., under Tubes). There is good reason to think that embryo hooks accompanied both the trivalve of 1818 and the quadri-valve and that another uterine clyster was excavated with the latter.⁷²⁸

In addition to the Pompeian specula six more examples and fragments of two others have come to light to make a total of eleven examples of the uterine speculum, all of Roman date, save for one that is likely Byzantine.⁷²⁹ This

724 See Schoene (1903) 281–282; Bliquez (1984) 195–196, 199. We also find the form διόπτρον in Michael Psellus, Poema 9, *De medicina*, line 1190.

725 The earliest use of *speculum* known to me in the sense of vaginal dilator occurs in the work of Bernard Gordon, a 15th century authority of the Salernitan School. J. Scultetus (17th century) may first have distinguished the vaginal model with the name *speculum magnum matricis*, adopted by Vulpes in 1848. Milne (1907) probably depended directly on Scultetus (see p. 8). Haussmann (1878) 375 & 382 cites the relevant passages of Gordon and Scultetus.

726 Rueff (also known as James) was a sixteenth century practitioner. The 1580 edition of his treatise on midwifery, etc. (book 4, p. 27) provides an illustration of his worm-driven trivalve model.

727 For all three sites see Bliquez, Jackson (1994) 65, 81–2, 84–5.

728 Bliquez/Jackson (1994) 11–13, 41–42.

729 In addition to the three in Naples from Pompeii we have: a fragment of a worm from Augst (Riha [1986] 89 Taf 61); a fragment from Varna (Künzl [1983a] 112 Moesia Inf. 5); and specimens from: Marcianopolis (Minchev [1982] 145; Kirova [2002] 81–84 and 87); Dium (Pantermalis [1997] 197–198 and Bouzakis-Pantermalis [2008] 633–642); Merida and Athens (Museum Würth, etc. [1995] 42, 181–182 and 185.); Mainz (Künzl [2002b] 31–2, Taff. 22–28); and Lebanon (Longfield-Jones [1986] 81–9, probably Byzantine). See Museum Würth, etc. (1995) 41–44 and 180–186 for good to marvelous illustrations of all of

dovetails with the literary sources, none of which are earlier than the second century, in which case their presence at Pompeii by 79 CE is the earliest evidence for their material existence. Yet, it is likely that these sophisticated worm driven devices were in circulation much earlier (see chapter above: The Hellenistic Contribution).

In addition to their intricate design, these specula also feature attractive decor in the form of acanthus patterns and ram's and snake's head finials.⁷³⁰ The snake's head finials occur on the two balancing bars used to maintain position in the case of the trivalves; the ram's head decorates each end of the cross-bar through which the worm passes in the case of the quadrivalve (Fig. 70c). The snake's head was surely intended as a symbol of Asclepius; the significance of the ram-head is uncertain, but it likely also symbolized something.⁷³¹

The mechanics of the trivalve model were treated first by G.M. Longfield-Jones (1986) 82–83, and I speculated on the operation of the Pompeian quadrivalve in 1994.⁷³² Several years ago a much more detailed account of the former's parts, workings, and other details was carried out by computer tomography.⁷³³ The focus then was on the specimen recovered by D. Pantermalis in 1993 at Dion/Dium.

It seems that the worms on these specula turn counter clockwise, though there are at least three exceptions, the Dion piece being one of them.⁷³⁴

these tools (esp. the Merida specimen), close up shots of several of the worms, and (186) A. Mutz' reservations re the fragment from Augst.

730 Ram (Pompeian quadrivalve); acanthus (Pompeii [Casa del Medico (11)], Athens); snake's head (both Pompeian specimens and those in Mainz [Asia Minor], and Athens).

731 A guess: On the Egyptian Papyrus of Tamenieu depicting the mating of Sky and Earth (Nut and Geb) there appear to the left of the panel two animal gods interpreted as representing creative power; see Powell (2007) 82(4.1). One is a ram, a manifestation of Osiris who was worshiped in the Temple of Isis just steps away from the Casa del Medico (1) and the other possible findspot for the quadrivalve, the House of Acceptus and Euhodia, both also located in Regio VIII; see Bliquez, Jackson (1994) 81–82 and Mau (1902) 168–185. The creator god Khnum was also depicted as a ram; see *The Oxford Encyclopedia of Ancient Egypt*, vol. 2, 231–232. If the owner of the quadrivalve was Egyptian, or simply had an Egyptian connection, such as training or practice in Alexandria, the image of a ram with creative power on an instrument applied to female genitals would not be inappropriate. For other Egyptian influence compare the hippopotamus with uraeus among the Bingen instruments (Künzl [1983a] cover and 83(57.1–3).

732 Bliquez/Jackson (1994) 63–4.

733 Bouzakis-Pantermalis (2008).

734 Athens, and the Pompeian quadrivalve are the other two. The genuineness of the Athens trivalve has been doubted, specifically because it works clockwise and is unprovenanced;

In addition to abscess of the womb, as cited above in Aëtius and Paul, we find the uterine speculum deployed for extraction of impacted embryo (Aëtius 16.23.14 [Philumenus]; Tertullian, *De Anima*, 25.4–5), treatment of imperforate vagina (Paul. 6.72.1) and a host of other conditions detailed by Aëtius. These include ulcerated womb (16.101.10; cf. Paul 3.66.1), cancer of the womb (16.106.11 [Archigenes]), imperforate womb (16.108.39 & 50), uterine hemorrhoids (16.109.4 [Aspasia]), poroi or stony growths in the womb (16.110.13), uterine thymi, myrmecia and acrochordon (16.117.8 [Philumenus]), uterine fissures (16.119.9), and a callous resembling millet grains (16.120.3 [Aspasia]).

Ring Knife for Dismembering Impacted Fetus

Hippocrates once mentions this device, which he refers to as a ‘claw’ or *onux* (*Superfetation* 7). Tertullian refers in passing to an *anulocultrus* used in abortion (*De Anima* 25.5). As he mentions Hippocrates in the same context, he may have the Hippocratic passage in mind. This may mean that the *onux* was unique to the Hippocratics and was not used in later times, a view prompted by the fact that there exists no surviving specimen.⁷³⁵ If this ringknife did exist under the Empire, it may lie behind the *onux* mentioned by Galen in his attempt to define the Hippocratic term *ichthue*:

It could also mean the iron/steel *onux* we use in aborting the fetus by extraction (*embruoulkia*) and cutting (*embruotomia*).⁷³⁶

The problem here is that Galen’s language allows for a hook or a hooklike knife as well as for a knife attached to a ring. For further discussion, see above, Gynecological Tools, under Hippocratic Surgeries and Surgical Tools; also the section below, Embryo Hook.

Stylet for Opening the Cranium of an Impacted Fetus

In cases where abortion is necessary but the fetus is not already dead Tertullian states that it was first dispatched with an instrument which he names *aeneum*

see Milne (1907) 152. But the Dion trivalve is also right-handed and its find-spot well documented.

735 There have been various candidates proposed, none convincing. For these see Künzl’s Forschungsbericht, (1996) 2555 (Ringmesser).

736 Hippocratic Glossary (19.107): δύναται δὲ καὶ τὸν σιδηροῦν ὄνυχᾳ δηλοῦν, ὥπερ εἰς τὰς ἐμβρυουλκίας καὶ ἐμβρυοτομίας χρῶμεθα.

spiculum but which, he says, the Greeks call ἐμβρυοσπάκτης (*embruosphaktes*).⁷³⁷ He adds that Hippocrates, Asclepiades, Erasistratus, Herophilus and Soranus all had this instrument (*De Anima* 25.5). *Aeneum spiculum* occurs solely in Tertullian and *embruosphaktes* nowhere in the preserved works of the authors he cites. But *embruosphaktes* is included on *Lists*, so it surely appeared somewhere in the surgical literature.⁷³⁸

Unfortunately, while Tertullian names the tool he does not describe it. Because in Latin *spiculum* or ‘little spike’ (and, by metonymy, ‘arrow’ ‘javelin’) suggests a needle, Milne envisaged an instrument like “the huge bodkins in the Naples Museum.”⁷³⁹ However, none of the Naples “bodkins” can be associated with a surgical provenience.⁷⁴⁰ A. Minchev subsequently produced as a candidate two fragments of a tool with “elaborate decoration—inlay of silver and one electrum ring.” These remnants were recovered in an important instrumentarium discovered in Devnja, Bulgaria, the ancient Marcianopolis.⁷⁴¹ Minchev provided no illustrations but recently a drawing has appeared (Fig. 77).⁷⁴² While this fragmentary tool was accompanied by a vaginal speculum and might therefore have had gynecological applications, it is unclear what purpose it served.

In the absence of an authenticated survival, it is here suggested that Tertullian’s *aeneum spiculum* was not a special tool at all but merely an appropriate lancet or scalpel. Soranus, while performing embryotomy, reduces the large or hydrocephalic infantile head by perforating it with what he calls an *embruotomon* (ἐμβρυοτόμον) or, alternatively, with the familiar, lancet-like polyp knife (*polupikon spathion*).⁷⁴³ Aëtius (16.23.40–44) and Paul (6.74.3)

737 For abortion with instruments and drugs, see also Ovid, *Amores* 2.14.27–8: *Vestra quid effoditis subiectis viscera telis, Et nondum natis dira venena datis?*

738 Schoene (1903) 282, Bliquez (1984) 199, Fischer (1987) 38(46).

739 Milne (1907), 157–158. The ‘bodkin’ Milne uses for illustration (Pl. LI.1) is actually a sharp hook.

740 Bliquez, Jackson (1994) 53.

741 Minchev (1983) 146. Chronology is uncertain. According to Minchev the instruments were found in “a large room of a house ruined by fire in the first half of the 5th century”, but he believes (148) that they were manufactured in the 3rd century and handed down from father to son for several generations. Kirova (2002) puts the date of destruction in the 4th century and the knives, speculum and ‘embryo hook’ (at least) also in the 4th century.

742 See Kirova (2002) 81.5(1) who accepts Minchev’s view. Kirova’s illustration most closely resembles the decorated fragmentary shafts of fine spoon probes: see, e.g., Riha (1986) Taf. 39.

743 *Gyn.* 4.11.3 Ilberg = 4.5.78 BGM. *Embruotomon* also makes its way onto *Lists*: Schoene (1903) 282; Bliquez (1984) 199; Fischer (1987) 37(45).

employ for the same purpose a polyp knife, a *katias*, a *skolopomachairion* (also lancet-like knives), or even a common scalpel. All of these knives serve to perforate the fetal skull just as Tertullian's *embruosphaktes/aeneum spiculum*. This allows for the possibility that any cutting/puncturing instrument, when used in *embryotomy*, whether the fetus was alive or stillborn, took on these names or *embruotomon*.⁷⁴⁴ That means that, pace Milne, no distinct instrument type lies behind them.

Cranioclast

In extracting a dead embryo Hippocratic gynecology recommends breaking up its head with a cranioclast (*Diseases of Women* 8.70.1–7L). This tool, called *πίεστρον* (*piestron*) is included by Galen in his *Hippocratic Glossary*, where he twice equates it with *embruothlastes* (ἐμβρυοθλάστης), the name used in his time.⁷⁴⁵ *Embruothlastes* cannot be found in surviving texts; but it surfaces again on *Lists*, where we also find *cefaloclases* (= *kephaloklastes*).⁷⁴⁶ These names for cranioclast must have occurred in treatises now lost.

Piestron and compounds in *-thlastes/-klastes* ('squeezing/crushing tool') favor a pliers-like apparatus. Meyer-Steineg secured a fragment of such an instrument for his collection, claiming that it came from Ephesus (Fig. 76).⁷⁴⁷ If genuine, the piece may be of Byzantine date based on its peculiar linear decor. Unfortunately, it is now lost.⁷⁴⁸

Embryo Hook

We have four extensive Imperial accounts, three in Greek, of the process Greeks called *embruoulkia*.⁷⁴⁹ This procedure involves the brutal extraction of an impacted fetus, requiring a special retractor called in Greek ἐμβρουολκός (*embruoulkos*), a term reemerging later on *Lists*.⁷⁵⁰

744 Meyer-Steineg believed that he had in his collection a specimen of the *embruotomon*; but the piece in question is merely a scalpel handle/dissector of the standard Roman type with its blade missing; see Künzl (1991a) 46(25) and (1991aa) I 532(25).

745 Cf. 19.104 & 130K where he also cites the term θλάστης for *piestron*. But θλάστης is nowhere to be seen in the present *Hippocratic Corpus* or in any other text.

746 Schoene (1903) 282, 284; Bliquez (1984) 197, 199; Fischer (1987) 37(45).

747 Meyer-Steineg (1912) 37 and Taf. VI.1.

748 See Künzl (1991a) 26, 48(29), (1991aa) I 533(29), and (1992) 203–5. The piece looks to be related to a hook with similar decor, which may have served as an embryo hook. The latter is still in Jena (Fig. 76).

749 See I. Mazzini (1996) for a full treatment of the procedure with additional sources for it.

750 Schoene (1903) 282, Bliquez (1984) 199, Fischer (1987) 37(45).

Soranus of Ephesus is the earliest Greek source (*Gyn.* 4. 9–11 Ilberg = 4.5.1–108 BGM), the subsequent treatments of Aëtius (16.23 [Philumenus]) and Paul (6.74) depending directly or indirectly on him. As Soranus' narrative is lengthy, it is best to treat it in outline. When the patient is properly secured to a bed and the labia dilated, the physician introduces the hook, lubricated in warm olive oil, clutched inside the fingers of the right hand, and guided by the left. After he sets the hook in any suitable place where purchase can be gained (e.g. the eyes, collarbones, etc.), he then sets a second hook. The hooks are then turned over to an experienced assistant who draws on them steadily, sometimes pulling them from side to side, while the physician himself maneuvers the position of the fetus and applies olive oil as a lubricant. As the fetus comes free, it may be necessary to remove the hooks and reinsert them at a higher level. It may also be necessary to amputate or evacuate parts of the fetus in the course of the procedure.

Celsus offers an equally lengthy description of the operation in Latin, warning of the extreme difficulty and risks involved. His account is similar to Soranus' though he deals only with a dead fetus, deploys only one hook (the operator using his left hand to guide the head) and does not require an assistant in its manipulation. Celsus also says about the form of the hook, which he refers to as an *uncus* (7.29.4–8), that it should be “everywhere smooth and with a short point” (*undique laevis, acuminis brevis*). Tertullian, who provides a term filled digression on surgical abortion in *De Anima* 25.4–5, adds that the hook was dull (*cum hebetate unco*). We have already seen that Hippocratics performed *embroulka*, employing a nondescript hook (ἐλκυστήρ) for the purpose.

In the same chapter Celsus also mentions a second *uncus*, which is similar in form but sharp on its inner edge. This is deployed when the fetus has to be dismembered, specifically when the neck must be cut through.⁷⁵¹ It must have proved impractical, as it is not mentioned in subsequent sources;⁷⁵² nor is there any surviving example. However, four instances of the *embroulkos* have come to light at Pompeii. These are housed in the Naples Museum. One and very likely all were come upon in instrumentaria including specula and other instruments of gynecology. Each consists of a handle of copper alloy into which there was pegged a robust iron hook. I say, ‘was’, because the hooks are

751 *Id unco fit, qui prioris similis in interiorem tantum partem per totam aciem exacuitur* (7.29.7).

752 Or is it? Such a hooklike knife may lie behind the ‘claw’ (δρυξ) mentioned by Galen at Hippocratic Glossary 19.107K. His language at least allows for it: δύναται δὲ καὶ τὸν σιδηροῦν δρυχα δηλοῦν, ὥπερ εἰς τὰς ἐμβρουλκίας καὶ ἐμβρυοτομίας χρῶμεθα.

almost completely gone now, although several can be seen on old photographs and drawings (Fig. 2, middle row, far rt.; Fig. 74).⁷⁵³

A retractor in the Meyer Steineg collection said to be from Ephesus may have been used as an *embruoulkos*. It differs from the Pompeian examples in being entirely of copper alloy and featuring serrations on its inner side (Fig. 76).⁷⁵⁴ One would be more inclined to see it as a lithotomy hook were it not for the fact that it resembles in decor the cranioclast for abortion figured above and has always been associated with it. Perhaps it was double purpose, serving both to extract stone and fetus. If the cranioclast is Byzantine, then so too would be the hook. Another hook (apparently all of copper alloy) now missing from the Meyer-Steineg collection in Jena has been widely accepted as yet another example (Fig. 75).⁷⁵⁵ However, it should be regarded with caution. In addition to being without provenience, it deviates from the Pompeian types in material and form. Note that it is much less sturdy than they and is said to have featured four holes, interpreted as a locking device for the second hook mentioned in the sources. But Soranus and his successors indicate that their hooks were operated separately when they observe that the hooks must be positioned in opposition to one another to insure that the traction be directed evenly.⁷⁵⁶

Hook for Removal of Accretions from Uterus

Aëtius 16.110 treats of ‘poros-like stones’ in the uterus. These, he says, should be gently extracted with an instrument called λιθαναβολεύς/*lithanaboleus* (11)⁷⁵⁷ after the stones have been pressured abdominally with the right hand and maneuvered to the cervix by two fingers of the left hand inserted rectally. The instrument in question is most likely a lithotomy hook or perhaps an elevator associated with bone work.

[Obstetric Forceps]

Although no ancient source mentions such an instrument, S. Baglioni in 1937 cited as evidence for its use by the Romans a relief in his own collection. Many

753 Bliquez, Jackson (1994) 41–42, 129 (83–6), Pl. XIV = Fig. 2 (middle row, far right), XVII (middle row, 5th and 6th from right), and XXI (upper row, 2nd from left).

754 See Künzl, (1991a) 26, 48(30), (1991aa) I 533(30), and (1992) 203–5.

755 Künzl (1991a) 60(65) and (1991aa) II 190(65). I am dubious about the specimen at Marcianopolis advanced by Kirova (2002) 84 w/ Fig. 5.2.

756 Soranus, *Gyn.* 4.10.2 Ilberg = 4.5.37–39 BGM: καταπείρειν δὲ καὶ ἀντίθετον τούτῳ δεύτερον, ὅπως ισότροπος καὶ μὴ ἑτεροκλινῆς ἐπισπασμὸς ἐπιτελῆται—. See Künzl (1991a) 60(65).

757 λιθαναβολέα καθείς ἐκλάμβανε ἡρέμα.

will be familiar with this relief and its outlandish depiction of an accoucher prominently displaying the instrument as he stands behind a matrona exhausted from childbirth. Some have taken the Baglioni relief seriously, but it has rightly been dismissed as a forgery.⁷⁵⁸

A passage in Avicenna cited in favor of the obstetric forceps by Francis Adams has been shown, upon close examination by Milne, to lend no support to its existence in classical times.⁷⁵⁹ In short the Chamberlen family still should be credited with the introduction of the obstetric forceps in the seventeenth century.

[*Uterine Probe*]

An object recovered from a Romano-British complex at Hockwold-cum-Wilton, Norfolk and now in the Castle Museum, Norwich (Acc. no. 697.966) has been conjectured to be a uterine probe, owing to its resemblance to the modern instrument.⁷⁶⁰ Alternatively, it is proposed that the piece might have served as the stylet (*embruosphaktes*) mentioned by Tertullian for dispatching a living impacted fetus (see above).

The piece consists of a tapering cylindrical shaft 25.5 cm long mounted on a handle octagonal in section and 9 cm in length. The tip of the shaft is now missing.⁷⁶¹ It is true that there are testimonia to sounding of the uterus, but no text mentions any special instrument for the purpose. Rather a simple probe (*mele*) is used (see above, Large (Uterine) Speculum). And no one has so far produced a convincing *embruosphaktes*. Objects identified as such should be found in a surgical context, preferably with other instruments of surgery. That does not seem to be the case with the item in Norwich.

For Uterine Dilators, see under Probes

Midwife's Chair

The first detailed description of the midwife's chair (δίφρος μαιωτικός) occurs in Soranus' treatment of its role in the birthing process (*Gyn.* 2.2.3–6 Ilberg =

758 See Perone (1990), who offers a brief account (based on information secured from knowledgeable authorities in Rome) of the history of the relief from its 'discovery' to its destruction by Baglioni's son after Baglioni's death in 1957. Künzl (1994) speculates on the reason for the forgery.

759 See Milne (1907) 155–157 re Adams' comm. on Paul 3.76. Adams believed he had seen an obstetric forceps in the Naples Museum, but he did not specify which instrument he had in mind. Milne thought the instrument in question might be the well-known sequestrum forceps, Inv. no. 78029 = Fig. 64.

760 Wells (1967).

761 Ralph Jackson informs me by letter that the tip shows evidence of filing.

2.1.20–144 BGM).⁷⁶² Soranus envisages a chair featuring a firm back, a crescent shaped seat, open in front, on which the gravida sits, and handles shaped like the Greek letter “pi” (πιοειδής) for her to grip during contractions. Such a chair is depicted in the well-known terracotta relief from the tomb of the midwife Scribonia Attike at Ostia (Fig. 78).⁷⁶³ Interestingly, the midwife seems to look away from the genitalia of the gravida, as Soranus directs (Gyn. 2.6.2 Ilberg = 2.1.124–126 BGM). The Ostia relief is roughly contemporary with Soranus and Antyllus.⁷⁶⁴

Soranus goes on to state (with disapproval) that some even attach to the lower part of the chair a projecting axle with windlasses and nooses to be used as an option to the embryo hook in cases of impacted fetus.

For other situations, mostly involving administration of uterine fumigations, see Fumigation and Warming Devices, below under Vessels/Containers.

Strigil or Spoon Used as Uterine Curette?

As we have seen, the Hippocratic author of *Nature of Women* (42P) prescribes winding a bit of membrane around a ξύστρον to curette thrombi formed on the cervix. It is uncertain whether he has in mind a small strigil or some spoon-like scraper, which is kept from unnecessarily irritating the surface of the cervix by the membrane.

I know of no record of the operation in the preserved literature of the Empire but Richard Caton, after consulting contemporary gynecologists, suggested in 1914 that a double scoop in the Colophon instrumentarium might have served the Hippocratic purpose (Figg. 48a–b). One of the scoops on this tool features a serrated, the other a sharp edge. A similar scoop with serrated edges had previously surfaced at Bingen and one with a sharp or perhaps serrated edge at Melos (see above, Bone and Tooth Instruments, s.v. Curette).

762 See also Muscio's Latin translation of Soranus (1 61 p. 21) where the chair is called *obstetricalis sella sive cathedra*.

763 For further illustration of birthing with the chair see the drawings and reproductions in BGM 2.123–134. A less well-known relief in private hands in Basel, Switzerland clearly shows the interior of the chair; see Sigerist (1951–1961) vol. 2, 316(8) and E.D. Phillips' (1973) illustration 3 between pp. 72 and 73. Owing to what I consider peculiar iconography, I am dubious as to the authenticity of this relief. See also M. Grmek and D. Gourevitch (1998) 339.

764 In the Hippocratic treatise *Superfetation* (8P) we find the placenta being teased out by downward pressure after the gravida is seated on a reclining chair that has been drilled through: ἐπ' ἀνακλίτου διφρου τετρυπημένου. This is surely an early version of the chair described by Soranus.

The former, damaged at one end, probably also featured a sharp edged partner.⁷⁶⁵ If Caton is right about the Colophon tool, the others too may have served as uterine curettes. But the primary purpose of such serrated-sharp edged scoops was most likely bone work.

Miscellaneous Parasurgical Items

Awl

There is included in the instrumentarium recovered in Pompeii's Casa del Medico (11), an eyed piece resembling an awl (Fig. 1, bottom row, under clysters). In fact, it probably is an awl and would be classified as such were it not found with such a rich variety of instruments. Accordingly, it has been seen as useful for probing; it might also have served to punch holes in material like leather in constructing a sling, or in some similar operation. As no other awl has been taken from a surgical context, and as we find no references to the use of one in medical literature, we can only guess as to its purpose in this case. See Bliquez, Jackson (1994) 53 and 163(218).

Feather

In a pinch, even the fine, sharp, firm edges of the shaft of a feather could be used for removing a small growth. Galen mentions one such situation involving myrmekia, a type of subcutaneous wart, in *Meth. Healing* 10.1011–12K = J-H 3.522–523:

Obviously the hollow shaft of the feather has to be commensurate with the thickness of the myrmekia so as to pressure it evenly on all sides; then you have to rotate the shaft while applying downward pressure. In this way you can extract the myrmakia, root and all, really quickly.⁷⁶⁶

Recommended for this procedure are the feathers of old roosters, or even eagles.

765 In fact it may be preserved among the other items recovered; see Künzl (1983a) 82 56(15). Other spoon-scoops of interest in this respect include a sharp edged model shaped like that from Melos, said to be from Italy (Jackson 1986 122(6) & 136–137) = Fig. 3 and another complemented by a snake's head finial at its opposite terminus, allegedly from Ephesus, in the Meyer-Steineg collection; see Künzl (1991a) 40(8) and (1991aa) 1 529(8).

766 *χρή δὲ σύμμετρον ἔχειν δηλονότι τὴν ἑαυτοῦ κενὴν σύριγγα τὸ πτερὸν τῷ πάχει μυρμηκίας, ἵνα τε πανταχόθεν αὐτὴν ἀκριβῶς σφίγγῃ, καὶ πειτα περιστρεψαί μετὰ τοῦ κάτω βιάζεσθαι· τάχιστα τε γὰρ ἂν οὕτω καὶ σὺν αὐτῇ τῇ ρίζῃ τὴν μυρμηκίαν ὅλην ἐκβάλῃς.*

In addition to this procedure we find feathers used in application of medicines (Aëtius 6.13.27 et passim),⁷⁶⁷ wrapped in leather to reshape a broken nose (Celsus 8.5.1) and even as elevators in the operation for varicocele (Oribasius, *Coll. Med.* 45.18.15 & 18).

Mortar and Pestle

There are frequent references in the literature to the use of mortars and pestles in the preparation of pharmaceuticals. They go by a number of names, among which we find for the mortar, ὄλμος (*holmos*), ἰγδῖον/ἰγδῖς (*igdion*),⁷⁶⁸ and θυία/θυιεία (*thuia*)⁷⁶⁹ in Greek sources and *pila* and the familiar *mortarium* in Latin. For the pestle δοῖδυξ (*doidux*) and ὑπερος (*huperos*)⁷⁷⁰ are the usual terms in Greek,⁷⁷¹ *pistillus-um* or *pilum* in Latin. As one might expect, mortar and pestle are often mentioned in conjunction. Dioscorides (*Mat. Med.* 1.33.1), for example, prepares almond oil by cleaning and drying four liters of bitter almonds and grinding them up with a wooden pestle (ὑπέρω ξυλίνῳ) in a mortar (ἐν ὄλμῳ), while Paul (3.59.5) makes a paste of white lead, wine and rose oil in a lead mortar (ἐν μολυβδίνῳ ἰγδῖῳ) with a lead pestle (μολυβδίνῳ δοῖδυκι).⁷⁷²

In addition to grinding, the mortar serves to mix and steep preparations.⁷⁷³ The pestle too is not always deployed for grinding and braying: Antyllus eliminates a ganglion by striking it with a pestle (δοῖδυκι).⁷⁷⁴

767 Oribasius, *Coll. Med.* 11.beta.14: ἀπόσυρε πτερῶ και χρῶ. For veterinary medicine, see e.g. *Hippiatrica*, Ex. *Lugd.* 89.3–4: ἔγχριε τὸν ὀφθαλμὸν μετὰ πτεροῦ.

768 Only Paul favors ἰγδῖον. The term μάκτρα, which can mean mortar, occurs once in a medical context, Nicander's *Theriaca* (708), where a scholiast equates it with a stone *igdion* or *thuia*. In the main the *maktra* is used for domestic operations. If we may believe Sextus Empiricus, *idgis* became obsolete (*Math.* 1. 234–5), but it still appears frequently as late as the *Hippiatrica* (e.g. *Cantabrig.* 80.13 and *Excerpta Lugdunensia* Section 81.11). We find the form ἰγδῖ in the Hippocratic *Gyn.* 88 and 103.

769 The form θυίς and a diminutive θυίδιον also occur: Galen, *Antidotes* 14.118 & 130K. Because it was an instrument for grinding/mixing, the θυία could occasionally be called ἀκόνη; so Galen in his *Hippocratic Glossary* 19.72K.

770 Also used of an instrument for reducing a dislocated shoulder; Paul 6.114.5.

771 We once find *elasma* used in the sense of pestle in Galen, *Antidotes* 14.104K (Crito's recipe for theriac).

772 We once find stone mortars (ὄλμους λιθίνους) ground by an iron pestle (ὑπέρω σιδηρῶ) in a non-medical context: Photius, *Bibliotheca*, Codex 250.448a. See edition of Henry, Vol. 7 (1974) p. 154 and translation into English by Stanley Burstein, ed. and trans. *Agatharchides of Cnidus On the Erythraean Sea* (London: Hakluyt Society, 1989), p. 63.

773 See Scribonius Largus, *Comp.* 22, 88, 89, 202, 206, etc. for mixing.

774 In Oribasius, *Coll. Med.* 45.10.4: εἰ τύχοι τῆς χειρὸς κατὰ καρπὸν εἶναι τὸ γαγγλίον, τιθεμένης ἐπὶ τινος μαλακοῦ, ἡρέμα τις παρεστὼς δοῖδυκι πλῆττει τὸ γαγγλίον· διαθλασθέντος γὰρ ἀπευθύνεται τὸ νεῦρον.

The literature is replete with information as to the material composition of mortars and pestles. There we find, in addition to the models of wood and lead just cited, references to copper alloy and stone. See, for example, Galen, *Simples* 12.243K (... ἐν θυίᾳ χαλκῇ καὶ δοίδυκι χαλκῶ) and Dioscorides, *Mat. Med.* 5.81.2 (... ἐν λιθίνῃ θυίᾳ δοίδυκι λιθίνῳ). Galen mentions a mortar of clay at *Cmpds. by Place* 13.345K (βαλὼν εἰς θυίαν ὀστρακίνην) and Scribonius Largus another at *Comp.* 111 (*teruntur haec fictile mortario*).

Particular types of copper alloy and stone are mentioned as well: Cypriot copper is mentioned by Dioscorides, *Mat. Med.* 5.79. 6 (... εἰς θυίαν Κυπρίου χαλκοῦ, ἔχουσιν δὲ καὶ δοίδυκα ἀπὸ τῆς αὐτῆς πεποιημένον ὕλης), and red copper or bronze in Paul 7.3.22.76 (χρυσοκόλλα... σκευάζεται δὲ ἐν θυίᾳ ἀπὸ ἐρυθροῦ χαλκοῦ...). Marcellus Empiricus several times specifies marble (e.g., *De Med.* 1.38: *Haec universa conteres in mortario marmoreo*...). In several cases he requires the mortar to be *nitidum* or *nitidissimum*, which perhaps means of polished metal, as would be the case with a new one.⁷⁷⁵ In fact, on one occasion he does stipulate that a preparation be ground *in mortario novo vel nitido* (*De Med.* 8.53). In Scribonius (copied by Marcellus) we find occasional emphasis on cleanliness, meaning that a clean mortar or pestle was not always a must.⁷⁷⁶

Dioscorides twice specifies a *thuia*, which he calls ‘Theban.’⁷⁷⁷ It is unclear whether by ‘Theban’ he refers to a particular form, material, place of manufacture or to a mix of such qualifiers. Uncertain too is a particular type intended for producing collyria (Aëtius 7.106.48: βαλόντες εἰς θυίαν κολλυριακήν).

Size is another qualification mentioned, some products requiring a large model, as in a recipe for theriac in Galens’ *Antidotes* 14.87K (καὶ τρίβειν ἰσχυρῶς πάντα κατὰ τὴν μεγάλην θυίαν μεγάλῳ δοίδυκι), some a shallow model, as for collyria in Aëtius 7.106.42 (βαλόντες εἰς θυίαν τινα οὐ βαθεῖαν). Similarly, a concoction in Nicander’s *Theriaca* 951 is created in a broad or wide model:

καὶ τὰ μὲν ἐν στύπῃ προβαλὼν πολυχανδέος ὄλμου μάξαι λαινέοισιν
ἐπιπλήσων ὑπέροισιν.

Toss the ingredients into the bowl of a capacious mortar (*holmos*) and knead them by pounding with stone pestles.

775 *De Med.* 8.74 & 126. Kollesch and Nickel prefer to render *nitidum* as ‘sauber.’ I entertain ‘polished’ because Marcellus uses *mundum* in the sense of ‘clean’ to modify these objects.

776 *Comp.* 74: *oportet...pila et pilo mundo contundere* = *De Med.* 14.6: *oportet...pilo mundo contundi*.

777 *Mat. Med.* 5.87.5 & 8: τρίβε ἐν θυίᾳ Θηβαϊκῇ.

Superior size and durability may have distinguished the ὄλμος from the ἰγδῖς and θυία. The three are sometimes equated by later commentators,⁷⁷⁸ but it seems in some passages that *holmos* is perhaps a deeper heavier duty mortar. In the passage just quoted from Nicander it is described as a ‘block’ or ‘stump’ (so also *Alexipharmaca* 70), and in another line of *Theriaca* (644) it is equated with a hollow block or a ragged/clefted rock, as though there was some cruder aspect to it.⁷⁷⁹ Here and there its ‘belly’ seems to be emphasized,⁷⁸⁰ and a deep bowl-shaped object like a tripod can be referred to as *holmos*.⁷⁸¹ In contrast, the *thuia* may be shallower. Galen once requires one in the form of a saucer-like vessel and, on another occasion, he finds a *thuia* as suitable for grinding as a whetstone.⁷⁸² Furthermore, we find in several sources that the *thuia* used by cooks, which one takes as a more refined grinder, is occasionally acceptable in pharmaceutical practice,⁷⁸³ and it is several times only used after an ingredient has been pounded in the *holmos*, as though the former were reserved for creating a finer ground product or paste. Aëtius, for example, cites a number of preparations using this sequence: for example, in preparing the ‘elephantine’ of Poles he says:

While still green, give the barks of alikakabon (probably = thornapple) and mandrake a good pounding in a *holmos*, then triturate them fine in a *thuia*.⁷⁸⁴

-
- 778 Examples: Aelius Herodianus et Pseudo-Herodianus, *Partitiones* 61.3... θύεια τὸ ἰγδίον; Scholia Nicandri *Theriaca*, Vita-scholion 506d.1: ὄλμω· ἐν δοίδυκι G ἐν ἰγδίῳ bd ἐν τῇ θυείᾳ f.
- 779 ἡ σφέλα ἡ ὄλμω κεάσας ἡ ῥωγάδι πέτρη. Among the Scholia to Theocritus mountaneous formations are compared to mythical *holmoi*: Scholia II 15/16a (Wendel, p. 274): φάρμακα· ἔτι καὶ νῦν ἐν τῷ Σεληναίῳ ὄρει ὄλμους δευκνύουσι τῆς Μηδείας καὶ Κίρκης ἐν οἷς ἔκοπτον τὰ φάρμακα.
- 780 Galen, *Antidotes* 14.85K: τῷ κύτει τοῦ ὄλμου; scholia to Nicander, *Theriaca* 951: ἐν στύπει· τῷ κύτει καὶ τῇ γαστρὶ τοῦ ὄλμου. Prompted by this scholion Gow-Scholfield actually translate 951 “into the belly of a capacious mortar.”
- 781 *Aristophanis Byzantii grammatici Alexandrini fragmenta*, 2nd edn., Ed. Nauck, A. (Halle: Lippert & Schmid, 1848, Repr. 1963), *Paroemiae* Fragment 8, line 5: καὶ Ἀριστοφάνης ὁ γραμματικὸς φησιν, ὡς οἱ ἐν ὄλμῳ κοιμηθέντες μαντικοὶ καὶ τοὺς τρίποδας τοῦ Ἀπόλλωνος ὄλμους καλεῖσθαι = William J. Slater, ed., *Aristophanis Byzantii Fragmenta post A. Nauck collegit, testimoniis ornavit, brevi commentario instruxit* (Berlin: Walter de Gruyter, 1986), p. 126: Frg. 356 (VIII p. 239 N.) ἐν ὄλμῳ.
- 782 θυίας τῷ τῆς φιάλης σχήματι κατασκευασθείσης (*Simples* 12.286K); παρατιβόμενοι θυίαις ἡ ἀκόναις... (*Simples* 12.195 & 198).
- 783 Galen, *Simples* 12.318K: τρίβομεν ἐν θυίᾳ τῶν μαγείρων; Oribasius, *Coll. Med.* 8.47.14: λείου τοὺς φοίνικας μετὰ τοῦ μέλιτος καὶ κόμμewος ἐν θυίᾳ μαγειρικῇ.
- 784 τὸν φλοῖον τοῦ ἀλικακάβου καὶ τοῦ μανδραγόρου χλωρὸν μὲν ὄντα κόπτε ἐν ὄλμῳ ἔπειτα λείου ἐν θυίᾳ (15.15.197–198). Similarly, see 6.92.60 and 12.59.9 and Oribasius, *Syn.* 3.5.2 [Galen].

If *igdis* and *thuia* are not equated at Dioscorides, *Mat. Med.* 5.89.2, *igdis* may sometimes designate the interior of the *thuia*:

You have to wash the aforementioned [chrusokolla mixed with earth and stone] in this way: when you have ground it up, put it in a *thuia*, pour water on it and rub it vigorously with the flat of your hand against the (its?) *igdis* (πρὸς τὴν ἰγδιν).⁷⁸⁵

Pila and *mortarium* seem analogous to *holmos* and *thuia* respectively; that is, the *mortarium* seems a somewhat less heavy-duty instrument producing a more refined product. In the absence of descriptive vocabulary we are guided by the verbs regularly accompanying these terms. With *pila* we invariably find the verb *tundo* and its compound *contundo* ('to strike, beat, pound'), while *mortarium* is found in the company of the subtler *tero* and its compound *contero* ('to bray, bruise, grind').⁷⁸⁶ Here there is an analogy with the verbs we generally find with *holmos* and *thuia*: κόπτω = 'to beat, pound' with the former, as opposed to τρίβω = 'to rub, bruise' and λειόω = 'to triturate, pound fine' with the latter. Scribonius Largus and Marcellus Empiricus contrast the operations of the two mortar types in the following passages.

In preparing medications to relieve diseased windpipe Scribonius tells us to allow gum, tragacanthum and Cretan raisin wine to macerate for 24 hours. Then, "on the next day beat together the compound with a *pila* and a clean pestle and carefully mix with the other ingredients that have been brayed in a *mortarium*." (*Postero die pila et pilo mundo contundere et cetera trita mortario curiose admiscere* . . . *Comp.* 74).

Again, Marcellus prescribes ingredients for pain in hip, loin, etc. "These are pounded in a *pila* or brayed in a *mortarium*." (*haec tunditur in pila vel teritur in mortario* . . . *De Med.* 25.14).

Noteworthy are the frequent occasions where we hear of a set manufactured for a specific purpose. A passage in Aëtius serves to illustrate:

Galen several times makes preparations κατὰ τὴν θυίαν (*Antidotes* 14.85 & 87K; *Simples* 12.189K). I am uncertain how, if at all, this phrase differs from the usual ἐν τῇ θυίᾳ. For alikakabon as thornapple (*Datura stramonium* L) see Scarborough (2012b).

785 πλυτέον δε τὴν προειρημένην οὕτως· κόψας αὐτὴν ἔμβαλλε εἰς θυίαν καὶ ἐπιχέας ὕδωρ τρίβε πλατεῖα τῇ χειρὶ πρὸς τὴν ἰγδιν εὐτόνως. Copied by Oribasius, *Coll. Med.* 13. chi.7.

786 An exception is Marcellus, *De Med.* 34.85 (*radicem* . . . *in mortario lapideo contusam* . . .). A similar heavy-duty verb with *pila* is *battuo* (*De Med.* 36.4).

Accordingly, when you have prepared a mortar of lead and a lead pestle, place in the mortar some light wine and rose oil . . . and grind these ingredients in sunlight or by a fire so that the lead produces a juice (2.66.4).⁷⁸⁷

In another instance a set is made up of red copper or bronze for the making of chrusokolla (Galen, *Simples* 12.243K).

Curiously, in contrast to ointment slabs, few mortars and pestles can be associated with certainty with an instrumentarium, whether in a grave or at a settlement site.⁷⁸⁸

Ointment Slab (Reibpalette), Whetstone

Ointment slabs are come upon frequently in instrumentaria taken from graves and from locations in Pompeii.⁷⁸⁹

Each such stone is rectangular at top and bottom with sides that are beveled or tapered (Fig. 3, bottom row, far left). Marks of wear on the broader surface indicate that this was the area on which substances were ground and mixed preparatory to consumption or application by means of, e.g., the *puren* of a spatula probe; thus the smaller surface functioned as a base.⁷⁹⁰ Some of these stones also apparently show evidence of being used as whetstones for sharpening.⁷⁹¹

787 θύϊαν οὖν σκευάσας ἐκ μολύβδου καὶ δοίδυκα μολύβδινον καὶ βαλῶν ἐν αὐτῇ οἶνον λεπτὸν καὶ ῥόδινον ἔλαιον . . . τρίβει ἐν ἡλίῳ ἢ παρὰ πυρί, ὡς ἀνιέναι χυλὸν τινα τὸν μολύβδον. For other examples of lead sets for a similar purpose, see Oribasius, *Eunap.* 2.mu.22 & 3.25.3.

788 In Pompeii we find them recorded for the House of the Medicus A. Pumphonius Magonianus and the Casa del Medico Nuovo (1); see Bliquez, Jackson (1994) 81–82. Seven stone mortars and seven stone pestles are also now reported for the Domus ‘del chirurgo’ in the Piazza Ferrari of Rimini; see Jackson (2009a) 70; Ortalli (2000) 517, 521–522, nos. 187a–n; and (Ortalli 2009) 32–33, Fig. 20. It is not clear that either a mortar or a pestle has come to light with tools in a grave. Deneffe (1896) 83–84 identified a copper alloy bowl in the trousse of Severus as such, but Künzl (1983a) 62(30.4) simply sees it as a Schälchen. Really any appropriate bowl would do, and a number of possibilities are included in recovered sets, but without the pestles that would help make a case; see Künzl (1983a) 46(13.1). The composite ‘Salbenreiber’ mounted by a finial assuming the form of Asclepius in the Meyer-Steineg collection might well have served as a pestle, if genuine: see Meyer-Steineg (1912) 48, Künzl (1983a) 49(17.1), Künzl (1991) 38(1).

789 See Künzl (1983a) 69(43.1), 75(49.2), 105(84), 106(85.12).

790 For their use see Riha (1986) 43 and the illustration on the front cover.

791 So reported by Milne (1907) 166, 171. There were also in the surgical collection at Naples a few slenderer rectangular stones without beveled edges that look to have been used exclusively for sharpening (see Fig. 1, upper row, below cups). I did not seek them out during my visits of 1985 and 1991; but they are treated by Milne, who reports their

Many such slabs have also surfaced at the Swiss site of Augst (Augusta Rauricorum).⁷⁹² Though few there can be associated with medicine or pharmacy, and, though most were likely used in the home for preparation of cosmetics, the Augst slabs are particularly relevant because they have been thoroughly studied; thus observations made and conclusions reached about them apply just as well to the slabs taken from the graves or houses of physicians.

The material composition of the specimens recovered at Augst has been analyzed. Some consist of limestone (Kalkgestein), some of vulcanite ('Silikatgestein'), and some of marble. Most, if not all, are thought to have been imported.⁷⁹³

The name for these stones was probably *ἀκόνη*/*akone* in Greek and *cos* in Latin. These terms are generally applied to whetstones. In Greek medical tracts *ἀκόνη* also designates a type of stone that was applied directly to an afflicted part to bring relief, or to a stone, the shavings of which were used in salves and oral medicines. But a number of references allow us to detect the ointment slabs of interest here. To cite several:

Galen prescribes gum and tragacanth to be ground up for an eye salve, "on the physician's *akone* (ἐπὶ τῆς ἰατρικῆς ἀκόνης)", and is quite specific when he prepares another such salve, "on an *akone* for eye conditions (ἐπ' ἀκόνης ὀφθαλμικῆς)."⁷⁹⁴

Marcellus Empiricus brays a collyrium with vinegar to treat headache on a *cos*: *De Med.* 2.16 (*in cote ex aceto teres . . .*).

Rods, Reeds for Hernia, Bone and Eye Work

According to Celsus (7.14.5), some strangle umbilical hernia between rods called *regulae*. In cases of distorted union, he also recommends pressuring projecting bone back into position with a *regula* wrapped in wool and bandaged in position (8.10.7N). Small reeds or leaves/plates (*petala*) to strangle eyelid

provenience as Stabiae and applies the name *ἀκόνη* to them. There are a number of references to a knife or iron blade being sharpened on an *ἀκόνη* to yield shavings of the latter for medicinal use (e.g., [Dioscorides], *Euporista* or *Simples* 1.89.1 and 1.125.1). I know of no example of a stone of this type that can be associated for sure with surgical instruments. Milne gives the ointment slabs considered in this section no name.

792 Riha (1986) 43–55 plus Taff. 18–24 splendidly presents these stones. Note especially the two medicine/cosmetic boxes surmounted by slabs on p. 45 from Andernach and a grave at Moghengo. For a similar piece in Naples: Bliquez, Jackson (1994) Pl. XVIII (second row, far left).

793 See the thorough treatment of these stones by M. Joos and W.B. Stern, in Riha (1986) 49–55.

794 *Simples* 12.196K, *Cmpds. by Place* 12.718 & 720K, and 12.607K; also Aëtius 6.81.2 and Oribasius, *Eunap.* 4.36.14; For eye conditions, see *Cmpds. by Place* 12.806K, *Simples* 12.193K.

tissue affected by trichiasis are acknowledged by Paul as an effective alternative to the suture operation (6.8.3).⁷⁹⁵

Scale, Steelyard

Not surprisingly devices to weigh ingredients for medications or finished pills are mentioned in the literature. Nicander directs the practitioner to bray and moisten simples in a mortar.

Next prepare round pills weighing one drachma, precisely limiting their weight with a scale (*plastinx*) . . . (*Theriaca* 954–955).⁷⁹⁶

Weighing devices have turned up at several surgical sites, including a scale and a steelyard in a grave at Rheims (Künzl [1983a] 63.32–64.33; Fig. 93), a scale—probably in a grave—at Colophon (Caton [1914] 118; Fig. 92) and several scales (*bilancie*) in Pompeian houses: the Casa del Medico Nuovo (I), the Casa del Medico Nuovo (II), and the Casa del Centauro (where there were two); see Bliquez, Jackson (1994) 83, 84, & 91.

Sieve/Strainer

The preparation of medicaments sometimes involved their being passed through a sieve. Greek literary sources refer to this item as ἡθμός and κοσκίνον. It is difficult to distinguish between the terms; several times ἡθμός and κοσκίνον are treated as equally acceptable alternatives, so there may not have been any appreciable difference (Galen *Diff. Fevers* 7.377K; Alexander of Tralles, *Fevers* 1.325.11; Aëtius 7.15.21 = Hirschberg, Waugh pp. 22–23. Chp. 15).

Authors writing in Latin call the sieve *cribrum/cribellum*. For example, for caeparia (a disease of the private parts) Marcellus says (*De Med.* 33.9):

Pulverem facito, et cribello medicinali omnem pulverem cerne et permisce et cum vino vetere calefacto locum inline.

Make a powder (of quince apple) and sift and mix with a medical sieve all the powder (of this and other ingredients) and anoint the place with old warmed wine.

795 δυοὶ καλαμίαις ἢ πεταλίοις τισὶν ἴσον ἔχουσιν τοῦ βλεφάρου μήκος, τὸ δὲ πλάτος ὅσον στενοῦ φλεβοτόμου.

796 καταρτίζοιτο δὲ κύκλους δραχμαίους πλάστιγγι διακριδὸν ἄχθος ἐρύξας. See also *Theriaca* 42 & 651 & Galen, *Antidotes* 14.39K. In addition to πλάστιγγιξ, we find reference to σταθμόν and ζυγόν in Galen, *Comm. Hipp. Aph.* 17b 815K.

Marcellus' stipulation *medicinale* suggests a special sieve for medicine and pharmacy; so too Galen, who records a concoction with dog dung prepared for synanche κοσκίνω ἱατρικῶ.⁷⁹⁷ How this *cribellum medicinale* might differ from ordinary types is unclear unless the use of the diminutive *cribellum* means that it was usually smaller. On the other hand Aëtius employs a culinary ἡθμός or κοσκίνον.⁷⁹⁸ So, it seems physicians also, if not usually, used sieves primarily intended for other purposes, such as several surviving copper alloy specimens of Imperial date in the British Museum.⁷⁹⁹ Copper alloy models are attested by Athenaeus (*Deip.* 14.647d).

There are a number of references to the gauge of openings. For wide gage see, e.g.: Dioscorides, *Mat. Med.* 1.66.2, copied by Oribasius, *Coll. Med.* 12.sigma.57 (δι' ἡθμοῦ εὐρυτρήτου); Scribonius Largus, *Comp.* 269 (*res... contusae et percribatae grandioribus foraminibus cribri*); Galen, *Cmpds. by Place* 13.283K (σῆθεται παχυτέρω κοσκίνω); and Oribasius, *Coll. Med.* 12 sigma.19.4 (κοσκίνον μὴ πυκνὸν ἐπίθες). For narrow or fine gauge see, e.g.: Dioscorides, *Mat. Med.* 2.80.6 (δι' ἀραιοῦ κοσκίνου); Galen, *Cmpds. by Kind* 13.1043K (ἀραιότερῳ κοσκίνῳ σήσας), *Glaucon, Meth. Healing* 11.135K (λεπτῶ κοσκίνῳ), *Cmpds. by Place* 12.436K (σῆθε λεπτοτάτῳ κοσκίνῳ), *Cmpds. by Kind* 13.635K (ἀκριβῶς διαττάν λεπτοτρήτοις κοσκίνοις); Scribonius Largus, *Comp.* 90 (*cribratur tenui cribro*); *Hippiat. Ex. Lugdun.* 187.3 (σῆσας πυκνῶ κοσκίνῳ) and Aëtius 3.136.67 (λειοτάτῳ κοσκίνῳ).⁸⁰⁰

Cloth of various textures was also used for straining, as shown by Aëtius 7.15.21 = Hirschberg, Waugh pp. 22–23. Chp. 15 (διὰ... ἡ ῥάκους ἀραιοῦ ἐκθλίψας) and Paul 1.88.1 (σειροῦται δι' ἡθμοῦ ἢ ῥάκους).

Other purposes for sieves include covering and sunning (Aëtius 11.12.9–10 (σκεπάσας [goat's blood] δικτύῳ πυκνῶ ἢ ὀθόνῃ ἀραιᾷ ἢ κοσκίνῳ πυκνῶ τίθει ὑπαιθριον ἡλιουσθαι) and sprinkling (Paul 4.48.5 καταπάττειν... διὰ κοσκίνου μετεώρου).

Another occasionally occurring term for a straining device is κυρτής. How this might have differed from κοσκίνον and ἡθμός is unclear. Perhaps it was a more heavy-duty instrument, as references to it have to do with material being squeezed or pressured, the residue being tamped out. So Dioscorides (*Mat. Med.* 1.52.2... ἀνελόμενος εἰς κυρτίδα ἐξίπου.), Galen (*Cmpds. by Place* 13.55K εἰς κυρτίδα βαλόντες ἐκθλίβομεν τὸ ὑγρὸν...) and Paul (7.20.11 ἀλουμένων τῶν σησάμων καὶ ἐκπιεζομένων διὰ κυρτίδων...). It may also be that it was made of

797 *Cmpds. by Place* 12.956K [Musa]; cf. also *Hippiat. Ex. Lugd.* 174.7.

798 φακὸν ἐψήσας καὶ δι' ἡθμοῦ μαγειρικοῦ ἢ διὰ κοσκίνου ἢ ῥάκους ἀραιοῦ ἐκθλίψας (7.15.21 = Hirschberg, Waugh pp. 22–23. Chp. 15).

799 As pictured by Johnston (1957) 228.

800 I am unsure what is meant by *Hippiat. Ber.* 11.22.4: σῆσας κοσκίνῳ ὀφθαλμικῶ. Cf. ὀφθαλμικὴ ἀκόνη above, Ointment Slab (Reibpalette), Whetstone.

wickerwork, for the same name is also applied to a kind of fish trap of rush or reed (Oppian, *Halieutica* 5.600, κυρτίδες ἡβαιαὶ ταλάροις γεγάσιν ὁμοίαι, πυκνήσι σχοίνοισι τετυγμέναι).

Spindle Hook

The Casa del Medico (11) confronts us with another curiosity, a spindle hook (Fig. 84, 3rd from rt.).⁸⁰¹ As with the awl found here, one can only guess as to the function of this common object. In this case we can at least point to another specimen recovered in a grave with pharmaceutical equipment (spoon probe, ointment slab, glass containers) at Varna.⁸⁰²

Tourniquet

In venesection of the arm Antyllus, as excerpted by Oribasius, distends the vein to be opened by applying a firm band two fingers wide as a tourniquet; this band he calls a *telamon* (τελαμών), a term he uses in bleeding other parts as well.⁸⁰³ Paul too produces an apropos chapter on phlebotomy in which he observes that, since the operation is most often performed at the elbow, a narrow band (*tainidion*) should be tied around a muscular part of the arm to produce maximum distension of the vein.⁸⁰⁴ Later in the same chapter Paul again uses the term to designate the tourniquet applied to the neck before division of the frontal vein to relieve headache.⁸⁰⁵ And when Paul treats of angioly for hemicrania, it is likely again the *tainidion* that is used for distending the vessels of the neck in preparation (6.5.1: τῇ διασφίγξει τοῦ τραχήλου). The variation in names is curious because Paul, as Oribasius, explicitly names Antyllus as his source. Elsewhere Oribasius uses terminology closer to Paul when he applies a *tainia* before bleeding the ankle in relieving female conditions.⁸⁰⁶ Finally, it is pretty clear that tourniquets were also used to impede the spread of venom in treating snakebite.⁸⁰⁷ A tourniquet of this type became known in modern times as the 'Band of Antyllus.'⁸⁰⁸

801 Bliquez, Jackson (1994) 53 and 128(82).

802 Künzl (1983a) 113.(88.4).

803 Oribasius, *Coll. Med.* 7.9.1: διαδετέον τὸν βραχίονα πρὸ τῆς διαιρέσεως τελεμώνι εὐτόνῳ...

804 6.40.3: δεῖ οὖν ταινιδίῳ στενῶ διαδησαί τι περὶ τοὺς μύας τοῦ βραχίονος μέρος...

805 6.40.6: ἐπιδήσομεν ταινιδίῳ κατὰ τὸν τράχηλον...

806 *Ecl. Med.* 146.9: τῇ διὰ σφυροῦ φλεβοτομίᾳ χρηστέον... διασφιγγομένου πρῶτον τοῦ ποδὸς ταινίᾳ.

807 See Aëtius' account of the bite of an ammodytes or cenchris. Unfortunately, we have only Cornarius' Latin translation to go by (13.25): along with cupping treat *et superiorum partium constrictione et ad ipsam plagam scalpelli admotione*.

808 So Milne (1907) 164.

Otherwise, *telamon*, *tainidion* and *tainia* are widely cited in the literature in the sense of bandage, sling, or cord/strap to keep bandages or medicated emollients in place. They vary in size and are made of linen, flax or wool.⁸⁰⁹ We can apply these qualifiers to those used as tourniquets as well.

It has been suggested that a pine shaft 25.3 cm in length found with several scalpel handles might have been used to twist tight a first aid bandage or wind a tourniquet. This was recovered with three scalpel handles from a shipwreck off Plemmirio, near Syracuse.⁸¹⁰

Wedge

In lancing an abscess of the tonsils, Oribasius recommends that the mouth be kept open with what he calls an oral dilator (στοματοδιαστολεύς/*stomatodiasstoleus*) or with a wedge of oak (σφηνάριον πρίνινον) positioned between the molars (*Coll. Med.* 44.11.13). It is clear what the oaken wedge would be, but it is difficult to know what lies behind the name *stomatodiasstoleus*. This may simply be another name for wedge or for a wedge-like device; but the pretentious name does not permit us to exclude the possibility that Oribasius here envisages some sort of virtuoso mechanical device that was never widely used, and so is mentioned by no other source.

Wedges are also mentioned by Oribasius as a means of keeping the mouth open when the patient is, e.g., in a catatonic state provoked by the administration of hellebore or is choking (*Coll. Med.* 8.6.7 & 21; 8.7.3 [Herodotus]). Caelius Aurelianus, however, opposes the practice of forcefully inserting wedges (*cuneos*) between the teeth of catatonic patients (*Acut. Diseases* 2.12.85).

In treatment of imperforate anus Paul severs the obstructing membrane with a scalpel and then prevents contraction by introducing a lead pipe (αὐλίσκος μολίβδινος) or a *spheniskos* (σφηνίσκος) treated with an ointment (6.81.1). On analogy with the pipe the *spheniskos* may be something hollow but fashioned in such a way as to look like a wedge.⁸¹¹

Otherwise, we find several references to the *spheniskos* in contexts indicating that a plug or tampon of rag is meant: e.g., Paul's treatment of bloody nose (2.58) and Aëtius' and Paul's accounts of arteriotomy and periskuphismos on the head.⁸¹²

809 Pseudo Galen, *On Bandages* 18a.785K (ταινία ὑπερμήκης); Oribasius, *Coll. Med.* 10.18.15 (τελαμώνας πλατεῖς ἐξ ἐρίων), 44.20.16 (τελαμώνας στενοὺς εὐτόνους), 48.28.6 (τοῦ πλατυτέρου τελαμώνος), 48.50.1 (τελαμῶνα πλάτει καὶ μήκει ἰκανόν); Paul 6.90.4 (ταινιδίους λεπτοῖς), 6.115.2 (πλατεῖαν ταινίαν), 6.117.5 (λινῶν τελαμῶνι ἢ στυππέῳ).

810 See Gibbons (1989) 12–13. The suggestion was a personal one from Künzl.

811 It may appear on *Lists* in a corrupted form (*feniscus*): Schoene (1903) 284; Bliquez (1984) 197; Fischer (1987) 35.

812 Aëtius 7.92.19 [Severus] and 7.93.8; Paul 6.4 and 6.7.

As items of wood or cloth would not easily survive in a buried instrumentarium, it is no surprise that nothing identifiable as a wedge has survived. In practice wedges often may simply have been constructed on the spot and then disposed of.

Two passages in the veterinary *Hippiatrica* refer to the use of a διαστολεύς (*diastoleus*) in depressing the tongue or accessing the pharynx of a horse.⁸¹³ We are probably dealing here with a wedge-like device used by veterinarians. Likewise, we hear in the same collection of a διαστόλιον (*diastolion*) to dilate the mouth in treatment of tonsillitis.⁸¹⁴

Vessels/Containers

Boxes (Rectangular and Cylindrical) for Storage

As we have seen, the *Hippocratic Corpus* is witness to storage and carrying cases for instruments (*Decorum* 9.8.7–8L). The archaeological finds of the Empire provide us with the first clearly recognizable containers for instruments and medications. Dioscorides offers a comprehensive account of the appropriate materials for storage of the latter (*Mat. Med.* preface 9.7–15 = Wellman 1, p. 5):

Flowers and such parts that have sweet-smelling fragrance should be laid down in small dry boxes of limewood, but occasionally they can be serviceably wrapped in papyrus or leaves to preserve their seeds. As for moist drugs, any container made from silver, glass or horn will be suitable. An earthenware vessel is well adapted provided it is not too thin, and, among wooden containers, those of boxwood. Copper vessels will be suitable for moist eye-drugs, and for drugs prepared with vinegar, raw pitch, or juniper oil. But stow animal fats and marrows in tin containers. (trans. By John Scarborough and Vivian Nutton (1982) 197.)⁸¹⁵

There are two basic types, survivals being mainly of copper alloy. The first is a small rectangular box, often divided into compartments and equipped with a

813 *Hippiat. Ber.* 2.20.10 and *Paris.* 460.6 (bulls' hide).

814 *Hippiat. Ber.* 16.2.8 and 18.1.8.

815 ἀποτίθεσθαι δὲ καὶ ἄνθη καὶ ὅσα εὐώδη τυγχάνει ἐν κιβωτίοις φιλυρίνοις ἀνοτίστοις, ἔστι δ' ὅτε καὶ ἐν χάρταις ἢ φύλλοις χρησίμως περιδεῖται πρὸς συμμολὴν τῶν σπερμάτων. πρὸς δὲ τὰ ὑγρὰ φάρμακα ἀρμόσει ὕλη πάσα ἐξ ἀργύρου ἢ ὑάλου ἢ κεράτων γεγενημένα, καὶ ὀστρακίνη δὲ ἢ μὴ ἀραιὰ εὐθετος, ξυλίνων δὲ ὅσα ἐκ πύξου κατασκευάζεται. τὰ δὲ χαλκᾷ ἀγγεῖα ἀρόμσει πρὸς τὰ ὀφθαλμικά ὑγρὰ καὶ ὅσα δι' ὄξους ἢ πίσης ὑγρᾶς ἢ κεδρίας σκευάζεται· στέατα δὲ καὶ μυελούς ἐν κασσιτερίνοις ἀποτίθεσθαι. See now also the translation of Lily Beck (2011) p. 5.

sliding lid or lids (sometimes facilitated by a grip in the shape of a cornice) and locking devices. Some, or all, of the compartments are sealed by covers raised by omega shaped wire handles. Figg. 79–83 may serve as examples.⁸¹⁶

Occasionally, the case has an upper and a lower level (Fig. 83).⁸¹⁷ Some examples feature an ointment slab acting as a sliding lid on one of the broad sides. In other cases the sliding lid is surmounted by a vaulted semi-sphere. On one of the long narrow sides there may be a small cylindrical case for instruments; these can also be accommodated within the box itself.

In addition to copper alloy, wooden (Fig. 89 far rt.) and ivory/bone examples, and even silver models are known.⁸¹⁸ Many specimens are decorated with engraved linear patterns, or with images of gods/heroes (especially Asclepius) and different secondary motifs executed in inlay (silver, niello, and red copper) or relief.⁸¹⁹ A splendid example showing the snake of Asclepius wound about a laurel branch with a surround of laural leaves was dredged from the Rhine in 1900. Unfortunately it is now lost, but at least a photo survives (Fig. 82).

In some instances uniform features point to a common origin (e.g. the atelier of Saciro).

A catalogue of these rectangular cases has been produced by Hildegard Sobel.⁸²⁰ Along with surviving examples she includes analysis of any substances still present in them and conjectures that the puzzling semi-sphere served to warm medicaments to make them easier to apply. To Sobel's catalogue we may add: 1) a wooden case found at Herculaneum, said to contain instruments and to be covered by a beveled slab⁸²¹ and 2) a copper alloy case from Cyzicus containing both instruments and pills (see below).

A type of hinged box with wooden dividers used for the storage of instruments like scalpels and bone elevators is shown on a number of votive and grave stones. These include a well-known offering from the Athenian Asklepieion now in the National Archaeological Museum in Athens.⁸²² Instruments kept

816 Other fine specimens include Scarbrough (1969) Illustration 30 and Jackson (1988) 75(18), perhaps from Asia Minor, length 12.6 cm; Künzl (1996) 2638–2639, 1st–3rd cent. CE; Künzl (2002b) Taff. 37–38(B120), length 12.8 cm, 1st–2nd CE, Asia Minor.

817 See Heres (1992) for this specimen from Cyzicus; also Bliquez, Jackson (1994) 2(F.c) for one found in Pompeii, now missing.

818 For examples of wood see Künzl (1983a) 95(76); for Silver see Künzl (1983a) 76(50.4).

819 Several are nicely illustrated by Künzl (1996) 2634–2637 Abb. XXXII–XXXIII.

820 Sobel (1991).

821 De Carolis (1993).

822 See Milne (1907) Pl. IV, Jackson (1988) 115(28), and especially Krug (2008) 32(16) who includes other examples: 13(7), 34(18), 35(20), 36(22), 37(23), 40(25) and opposite the title page.

in such boxes are distinguished by fragments of wood still clinging to them.⁸²³ Leather containers have also been recovered with instruments at sites like Wehringen.⁸²⁴

The other type of case is cylindrical and occurs in much greater numbers (Fig. 2, middle and bottom rows *rt.*; Fig. 3, middle row, far left; Fig. 29.28 & 29; Fig. 84). This type may have evolved from hollow reeds in which medicine or cosmetics were placed. So one concludes from the fact that the word *kalamiskos*, or 'little reed', seems to have been current for such a container in the 5th century BCE.⁸²⁵ Some models are quite long (up to 20 cm), others shorter and squatter. Each was equipped with a cylindrical lid (sometimes flat, sometimes slightly domed on top), often decorated with one or more raised rings. In at least one instance this type of case is segmented and the individual segments are 'stacked', the one into the other (Fig. 3, middle row, far left; Fig. 85).⁸²⁶ To a lost specimen, perhaps from Herculaneum, a basanite slab with beveled edges was attached for sharpening scalpels and grinding medicaments.⁸²⁷ The Mainz Museum has a number of medicine containers made up of two cylindrical cases bound with a third smaller case containing a rod ('Salbenreiber') to mix and apply their contents. Each of the containers is topped with a domed lid attached to its container by a small chain that kept the lid in place.⁸²⁸

As mentioned, both types of case were used in the storage of instruments and medicaments. A two level specimen of the rectangular type from Cyzicus (Fig. 83), now lost, held two forceps, an ear probe, a spatula probe, two sharp retractors (one combined with a needle) and three scalpels in one level and, it is thought, medicaments in the other.⁸²⁹ Another rectangular case with four compartments from the Casa del Medico dei Gladiatori in Pompeii still contains pills, as did several others once in the Naples Museum and now lost.⁸³⁰ Several cylindrical cases from Pompei in the Naples Museum also still contain medicines, while the instrumentarium contained in another from the Casa del Medico Nuovo (11) includes a simple probe, a needle, a spindle hook,

823 Jackson (1986) 135–36.

824 Künzl (1983a) 120–21(95–96).

825 Cf. Aristophanes, *Acharnians* 1034 and scholion.

826 Jackson (1986) 130(36) & 159, Italy.

827 See Bliquez, Jackson (1994) 2(G).

828 Künzl (2002b) Taff. 38–40(B121–25, 127–30) 4th–5th cent. CE. A small case said to be from the 'Holy Land' is kept in the Classics Department of the University of Washington (Seattle). It similarly features a spherical lead lid rebated so as to fit into the cylindrical case and kept in place by a peg attached to a chain; see Bliquez (1998a) 86(17) & 88.

829 Heres (1992).

830 Bliquez, Jackson (1994) 2 (F.b), 66 and 191(296).

a retractor-needle combination, a ligula, a spatula, and a cataract needle (Fig. 84).⁸³¹ As these cylindrical cases abounded at Pompeii, we need not imagine that they were all the property of a physician. Many must have been home medicine kits, cosmetic containers, or have held substances used for more sinister purposes.⁸³²

A spectacular recent find is the recovery of a set of small cylindrical containers of boxwood (ca. 100 CE) with their medicaments still intact that have been raised from the Gulf of Baratti and are now in Florence.⁸³³

It remains to sort out the appropriate ancient nomenclature for these compartmentalized rectangular cases and the cylindrical models. The references, unfortunately infrequent, include in the Greek literary sources πυξίς ἱατρικῇ, δέλτος/δελτάριον, ἱατρικὸν ἐγχειρίδιον, νάρθηξ/ναρθήκιον (*puxis, deltos/deltarion, encheridion, and narthex/narthezion*). In Latin we find transliteration of the Greek terms (esp. *puxis/pyxis*) and, perhaps in the lay community, *theca*.

The terms *encheridion* (as *incliridiun*), *narthezion* (as *nasticium*) and *deltarium*, but not *puxis*, are found on *Lists*.⁸³⁴

Encheridion was technically anything held in the hand, such as a knife. That it might contain instruments is clear from Isidore's *Etymologiae* (4.11.1);⁸³⁵ that it had associations with medicine we owe to references such as that in Eustathius' Homeric commentaries.⁸³⁶ Unfortunately we are still left in the dark as to the shape of the container involved.

We are on firmer ground with *puxis*, which looks applicable to the cylindrical type though, given the loose use of nomenclature to which we have become accustomed, we cannot preclude its use for other types as well. At any rate, Philo of Byzantium and Heron of Alexandria apply the name *puxis* to cylinders used in various mechanisms, Philo comparing his cylinders to πυξίσιν ἱατρικαῖς.⁸³⁷ This information tallies well with the boxwood set now in Florence, the term πυξίς deriving in origin from the word for 'boxwood' (πύξος).

831 Bliquez, Jackson (1994) 84–6(6) with Pl. xxvi.1.

832 Such as poisons: see Cicero, *Pro Caelio* 25.61, *veneni pyxidem traditurum*; Juvenal 13.25, *partos gladio vel puxide nummos*.

833 Spawforth (1990).

834 Schoene (1903) 284; Bliquez (1984) 197; Fischer (1987) 39(62–64).

835 *Enchiridion dictum quod manu adstringatur dum plurima contineat ferramenta*.

836 *Commentarii ad Homerī Odysseam* 2.55.24: διχῶς δέ φασιν ἢ πήρα. λέγεται γὰρ οὕτω καὶ δ φέρουσιν οἱ ποιμένες ἐπ' ὤμων καὶ ἱατρικὸν δέ τι ἐγχειρίδιον.

837 Heron, *Pneum.* 1.28; Philo, *Bel.* 77.28 (ed. H. Diels, E. Schramm in *Abhandlungen der preussischen Akademie der Wissenschaften, Philosophisch-Historische Klasse*, Nr. 16, 1918).

The *theca* too is probably a *puxis* if Martial has a barber keep his razor in a *curva theca* (XI. 58. 9).⁸³⁸

The term *narthex/narthekion* also must belong in this category. Lucian makes fun of incompetent physicians with their ivory *narthekes*, silver cupping vessels and gold inlaid scalpels, and a papyrus refers to *νάρθηκες* *ιατρικοί* of ivory and wood.⁸³⁹ Basically, the name *narthex* denotes the giant fennel (*ferula communis* L.), therefore a plant with a segmented firm round hollow stem; hence its probable application to cylindrical medicine containers.⁸⁴⁰

The name *καλαμίσκος*, usually applied to drainage tubes or cannulae (see s.v. under Tubes), may also have been current for the *puxis* type. The scholiast to Aristophanes' *Acharnians* 1034 thought so in interpreting a farmer's cry for a drop of peace to be instilled "into this here *kalamiskos*" as "the bronze or silver one, such as doctors have."⁸⁴¹

As stated, survivals of the cylindrical type are overwhelmingly of copper alloy or wood. However, assuming we are correct in applying to these cylinders the name *puxis*, the literature is also witness to versions of clay, horn, lead, iron, silver and silver alloyed with lead, in addition to copper.⁸⁴²

We seem also on firm ground with rectangular cases of all sizes and materials. Klaus-Dietrich Fischer has shown convincingly that *deltos* and also the term *δελτάριον* (*deltarion*), lately attested among the published Oxyrhynchus papyri (*Poxy* LIX 4001, 4th cent. CE) is likely the proper term for them.⁸⁴³ He bases his argument chiefly on: 1) a passage in St. Basil's *Hom. dicta in Lacizis*

838 For Helbig's view and a critique see G. Lafaye in *Daremberg-Saglio, Dict. des antiquités grecques et romaines*, etc. IV 108b.

839 *Ignorant Book Collector* 29 (... ἐλεφαντίνους νάρθηκας καὶ σικύας ἀργυρᾶς ποιοῦμενοι καὶ σμίλας χρυσοκολλήτους...); *PSI* (Laur.) 22011; see also Martial 14.78.1 (*artis ebur medicae narthecia cernis*).

840 The stalk may also be used to stir mixtures: Galen, *Cmpds. by Place* 12.490–491K: *κινῶν νάρθηκι*.

841 εἰς τὸν καλαμίσκον· τὸν χαλκοῦν ἢ ἀργυροῦν οἷους ἔχουσιν οἱ ἱατροί.

842 For clay: Marcellus Emp., *De Med.*, 27.25 (*in pyx. fictili*). For boxwood and horn: Pliny, *Nat. Hist.* 29.124 (*corneisque pixidibus*); Marcellus Emp., *De Med.* 20.92 (*in pyx. buxea*) and 27.8 (*in pyx. cornea*). For oaken models: Galen, *Cmpds. by Place* 12.438K (μίξας ἀνελοῦ εἰς πυξίδα πρινίνην). For metals: Marcellus Emp. *De Med.* 8.120 (*in pyx. aeris Cyprii*), 8.19 (*in pyx. cuprea*), 19.46 (*in pyx. aerea*), 22.20 (*in pyx. argentea*), 35.10 (*in pyx. stagna*); Dioscorides, *Mat. Med.* 5.78.4 (ἀνελοῦ... εἰς πυξίδα ἐρυθροῦ χαλκοῦ), 5.87.8 (ἀπόθου εἰς μολύβην πυξίδα); Galen, *Cmpds. by Place* 12.686K (μετὰ δὲ ταῦτα ἐπίβαλλε... εἰς πυξίδα μολυβδίνην...), Scribonius Largus, *Comp.* 228 (*pyxidi nigri plumbi reponere*); Oribasius, *Ecl. Med.* 85.4 (τὰ μὲν ἄλλα κόψας καὶ σήσας ἀπόθου ἐν πυξίδι χαλκῇ ἢ σιδηρᾷ).

843 Fischer (1997).

which describes surgical *deltoi* as compartmentalized and containing drugs;⁸⁴⁴ 2) the *Hermeneumata Monacensia* which includes *deltos* among names of surgical instruments;⁸⁴⁵ and 3) on the fact that *Lists* (specifically Paris lat. 11219) arranges *deltarium*, *enchiridium* and *narthecium* together in sequence, the latter two clearly surgical containers.⁸⁴⁶

Multipurpose Vessels

Archaeological excavation of graves and sites provide, in addition to the boxes and cylinders just considered, abundant copper alloy,⁸⁴⁷ glass,⁸⁴⁸ clay,⁸⁴⁹ iron⁸⁵⁰ and even silver⁸⁵¹ containers of various kinds which clearly were intended for the storage and preparation of medicaments (Figg. 86–91). Unfortunately, sorting out the names applied to them in the literary sources is not easy. To

844 PG. 31, col. 1444; ἐὰν παραστής τῷ ἱατρῷ, καὶ ἰδῇς τὴν πολυτέλειαν τῶν φαρμάκων ἐν ταῖς πολυπτύχοις ἀποκειμένην δέλτοις...

845 The gloss (*deltos tabula*), though it mistakenly identifies *deltos* as the familiar waxed writing tablets of the Greco-Roman world, none-the-less associates the word with rectangular objects.

846 *Deltos* also occurs in Galen's *Anat. Proc.* 2.607K = 11.429Gar. In exposing the heart of an animal being dissected he recommends severing ribs from sternum "with a sharp strong scalpel" (ῥεῖξτε τε ἅμα καὶ ἰσχυρῶ σμίλῃ). The passage continues: τοιαῦται δὲ εἰσὶν ἐν ταῖς κεφαλικάῃς ὀνομαζομέναις δέλτοις ταῖς ἀρχαίαις· ἔχουσι δὲ καὶ οἱ τῶν ἵππων ἱατροὶ τοιαύτας σμίλας. Translated literally we read: "Such are found in the *kephalikai* called *deltoi*, the old kind. Equine veterinarians also have such scalpels." *Kephalikai* and *deltoi* have been translated by Singer (1956) as a type of instrument container, but clearly the former refers to the *smilai* mentioned in the previous and following sentences. That leaves *deltoi* as maybe referring to old books/tablets in which Galen's information was found. But on the whole the passage is likely corrupt and can be disregarded; so Garofalo ad loc., 'vix sanum.'

847 Como (1925) 153 and Abb. 1; Künzl (1983a) 81(55.1–6).

848 There were in the Domus 'del chirurgo' at Rimini a considerable number of glass vessels to judge by the puddles of glass created by the conflagration that destroyed it; see Jackson (2003) 314 & 321. Some idea of their shapes and sizes can be gleaned from the illustrations in Caton (1914) 118(xvi) with Pl. xii(36 Colophon), and Künzl (1983a): 46(13.2 Asia Minor), 89(66.5–6), 92(70.13–15; 71 and 72 all Cologne), 94(74 Nijmegen), 113(88.5–7 Varna), 115(90.2 Salzburg). See also Troisi (1981) for a small lead medicine bottle from Bari (2nd–1st BCE) containing wormwood or flea wort (either *Artemisia campestris* L., or *Plantago psyllium* L.).

849 Künzl (1983a): 62(30.4–6, 31.3 Rheims), 70(44.4 Strée), 73(47.6 Wederath), 88(64.1 & 3 Cologne), 89(65.4 Cologne), 92(70.12 Cologne), 115(90.1 Salzburg); Jackson (2003) 320(5 Rimini).

850 Künzl (1983a): 62(31.3 St.-Germain-en-Laye); also 81(55.1 Bingen) for copper alloy.

851 Künzl (1983a) 46(13.1 Asia Minor).

muddle matters some of these names likely also could be applied to the containers treated above where storage is an issue. As with so many items used by physicians, most of these vessels surely bore more than one name. Indeed some are explicitly equated in the literary sources. Furthermore, the literature attributes the same material composition to many of the names at issue and applies to them similar, if not the same functions. This complicates linking text and recovered object. Be that as it may, we can at least see in a general way through the sources the purposes to which vessels excavated from physicians' graves were put.

We may begin with a broad category, *σκεῦος/skeuos* and its diminutive *skeuaron*, for both occur regularly in surgical tracts in connection with containers made of clay, horn, wood, glass, copper alloy, red copper, tin, lead and silver.⁸⁵² In addition to storage, we are told that the *skeuos* was used to prepare drugs and medicinal applications by boiling, warming, dissolving or soaking, as well as by exposing ingredients for evaporation or curing. It might also be deployed for collecting bodily fluids as in Galen's, *On Prognosis* 14.668K = Nutton p. 136 (blood from nosebleed) and *Comm. Hipp. Aph.* 18a.183K (urine).

In use the *skeuos* might need a covering or stopper,⁸⁵³ the process involved might require (as with mortars) a new or fresh model, and a particular place, circumstance, or time might be stipulated for deployment. The following passages are illustrative:

In preparing ingredients for the treatment of hair loss at *Cmpds. by Place* 12.431K Galen says:

Put them in a new clay *skeuos* after you have moistened and carefully anointed/greased it all around. Store it in a place not too moist or warm and leave it underground for three months. Then take up and use the oil.⁸⁵⁴

852 Glass (Paul 7.11.11.13 and 7.14.1.26; *Hippiatrica, Ex. Lugd.* 89.3); silver (Oribasius, *Ecl. Med.* 48.13); glass or silver (Galen, *Cmpds. by Kind* 13.1057K); lead (*Hippiatrica Paris.* 453.7–8); copper alloy (*Hippiatrica Paris.* 20.4); red copper (Oribasius, *Ecl. Med.* 11.2); wood or horn (*Hippiat. Ber.* 11.29.4); tin and boxwood (Galen, *Cmpds. by Kind* 13.1050K); wood or clay (Oribasius, *Ecl. Med.* 118.6).

853 For covering with lids (sometimes pierced): Galen, *Comm. Hipp. Epidem.* 6, 17b.153K (Wenkebach p. 208): ἐπίθεμα ποιήσαντες ἀρμόττον τῷ σκεύει; Aëtius 1.115.6: περισφίγγειν δὲ ἀκριβῶς τὸ στόμα τοῦ σκεύους; Aëtius 12.55.34 σκεπέσθω δὲ τὸ σκεῦος πῶματι; Galen, *Cmpds. by Kind* 13.1044K (πῶμα).

854 βάλει εἰς σκεῦος καινὸν ὁστράκινον προβρέξας τὸ σκεῦος καὶ ἐπιμελέστατα περιχρίσας, κατάθου αὐτὸ ἐν τόπῳ μῆτε λιαν νοτερῷ μῆτε θερμῷ καὶ ἕα ὑπὸ τὴν γῆν μῆνας τρεῖς, εἴτα ἀνελόμενος χρώ τῷ ἐλαίῳ.

Again, Oribasius (*Ecl. Med.* 118.6) prepares the blood of a sea turtle as follows:

Put the turtle on its back in a wooden or clay *skeuos* and quickly behead it. When the blood has coagulated, divide it up into many pieces with a reed, cover with a sieve and put it out in the sun. When it's dry, take it up and use it for viper bites.⁸⁵⁵

Oribasius prescribes similar conditions in concocting a preparation for nasal polyp (*Ecl. Med.* 11.2):

When you have ground the ingredients smoothly together and put them in a red copper *skeuos*, dry them in the sun in the August heat.⁸⁵⁶

Sometimes the term *skeuos* represents an arrangement resembling the modern double boiler, that is, one pot positioned in or over another. We may again cite Galen, this time in connection with compounds called 'solubles' (τηκτά).

It's better to dissolve this (galbanum) in a double boiler (ἐπὶ διπλοῦ σκεύους). This is the name we use when another vessel (σκεῦος) with solubles and containing also the galbanum is set in a *kakkabe* (for which, see below) filled with hot water while a fire is kindled up under the *kakkabe*.⁸⁵⁷

There is no reason to think a *skeuos* was usually anything other than a common pot or container, though occasionally one was specifically designated as medical.⁸⁵⁸

Other sample passages describing the various functions of the *skeuos* include:

855 ἐπὶ ξυλίνου ἢ ὀστρακίνου σκεύους ὑπτίαν κατακλίνας τὴν χελώνην ταχέως αὐτῆς τὴν κεφαλὴν ἀπότημε καὶ παγὲν τὸ αἷμα εἰς πολλὰ αὐτὸ καλάμῳ καταδίελε καὶ πώμασον αὐτὸ μετὰ κοσκίνου καὶ ἀπόθου εἰς ἥλιον· ὅταν δὲ ξηρανθῇ, ἀνελόμενος χρῶ ἐπὶ τῶν ἐξεοδήκτων...

856 λειοτριβήσας ὁμοῦ καὶ βάλλων εἰς σκεῦος ἐρυθροῦ χαλκοῦ ἐν ἡλίῳ ξήραине ἐν τοῖς ὑπὸ Κύνα καύμασι.

857 *Cmpds. by Kind* 13.629; βέλτιον δὲ ταύτην (sc. χαλβάνην) ἐπὶ διπλοῦ σκεύους τήκειν. ὀνομάζομεν δὲ οὕτως ὅταν ἐν κακκάβῃ θερμὸν ὕδωρ ἐχούσῃ σκεῦος ἔτερον ἐνίσταται μετὰ τῶν τηκτῶν ἔχον καὶ τὴν χαλβάνην ὑποκαιομένης τῆς κακκάβης. For other examples, see Galen, *Cmpds. by Kind* 13.640K (ἐπὶ διπλοῦ δηλονότι σκεύους); Oribasius, *Ecl. Med.* 73.27 (ἐψεται διπλῷ σκεύει). The arrangement is also referred to as διπλωμα; see Aëtius 16.86.8–9 (τήκε δὲ ἐν ἀργυρῷ σκεύει ἢ ὑελίνῳ ἐπὶ διπλώματι); Oribasius, *Coll. Med.* 11.mu.16 (ἐν διπλώματι ταχεῖς).

858 Oribasius, *Eunap.*, Preface 1: μῆτε ὀργάνου τινὸς μῆτε σκεύους ἱατρικοῦ προσδεθῆεις μηδενὸς δυσπορίστου.

Boiling: Aëtius 6.91.25 (remedy for fetid nasal polyp): “Boil all fine/smooth/soft ingredients together in a copper *skeuos* and when the mixture has the consistency of honey take it up and use it.”⁸⁵⁹

Warming: Galen, *Cmpds. by Place* 12.916 (application for boils): “... oil of mastic warmed on a double boiler.”⁸⁶⁰

Mostening, steeping: Aëtius 6.50.57 (for headache): “Steep swallow droppings ... and nest clay in vinegar in a wooden *skeuos* and apply.”⁸⁶¹

As the reader has been warned to expect, the name *skeuos/skeuarion* may apply to other containers, especially when similar activities are involved. This brings us to ἄγγος, and especially its diminutive ἄγγεῖον/*angeion* (basically ‘vessel’) with which it seems particularly interchangeable. Galen, *Cmpds. by Kind* 13.1055K serves as an example. Here a double boiler placed in a *chutra* for heating is used to prepare a balm called *murakopon* for muscle strain. The double boiler is called both *diploon skeuarion* and *diploon angeion*. So also *skeuos* is equated with *angeion* at *Cmpds. by Kind* 13.1044K (where a σπεῖρα or coiled stand is placed underneath) and again at *On Prognosis* 14.668K (= Nutton p. 136).⁸⁶²

Even without their names being explicitly linked, we might have guessed that *skeuos* and *angeion* were often interchangeable from their many similarities. Both feature basically the same range of material composition.⁸⁶³ As to function, like the *skeuos*, we associate the medical *angeion* with storage and also with procedures as diverse as mixing, brewing, reducing, and cooking

859 ἔψε πάντα ἅμα λεῖα ἐν χαλκῷ σκεύει καὶ ὅταν μελιτώδῃ σύστασιν λάβῃ ἀνελόμενος χρώ.

860 ... τὸ σχίνινον ἔλαιον ἐπὶ διπλοῦ σκεύους χλιαινόμενον.

861 χέσματα χελιδόνων... σὺν τῷ εὐρίσκομένῳ ἐν τῇ καλιᾷ πηλῷ βρέξας ὄξει ἐν ξυλίνῳ σκεύει κατάρχει.

862 Similarly, Galen equates a portable urinal (ἀμῖς) with *skeuos* at *Aff. Parts* 8.330K.

863 The following random examples from Galen illustrate this well enough: clay (*Cmpds. by Kind* 13.827K: βάλλεται εἰς ἄγγεῖον κεραμοῦν); tin, glass, gold, wood, horn, silver (*Antidotes* 14.48K ἡ δ' ἀπόθεις ἐν ἄγγειῳ καττιτερινῷ ἢ ὑαλίνῳ ἢ χρυσῷ γενέσθω and 14.99K ἀπόθου φυλάττων μὴ ξυλίνους ἄγγείοις, ὑαλίνους δὲ μᾶλλον κερατίνους τε κάργυροῖς...); copper alloy (*Cmpds. by Kind* 13.776K εἰς χαλκοῦν ἄγγεῖον κατετίθετο and 13.855K ἀποτιθέμεθα εἰς ἄγγεῖον χαλκοῦν Κύπριον); and lead (*Cmpds. by Kind* 13.1024K εἰς ἄγγεῖον μολυβδοῦν ἀδιάπνευστον φύλαττε). See *Comm. Hipp. Aph.* 18a.183K for the usefulness of transparent glass models in uroscopy.

pharmaceuticals over coals,⁸⁶⁴ sometimes supported on coiled stands.⁸⁶⁵ The *angeion* was likewise used for moistening/steeping,⁸⁶⁶ warming (sometimes over ashes),⁸⁶⁷ melting,⁸⁶⁸ parching, exposing ingredients to the sun,⁸⁶⁹ and burying them for a month in manure.⁸⁷⁰

As a *skeuos/skeuarion*, an *angeion* may need a lid or covering,⁸⁷¹ may sometimes be a new or fresh model,⁸⁷² or may be a ‘doubled type.’⁸⁷³

There are contrasts between the two in that the literary sources refer now and again to special conditions or features of the *angeion*. These include recommendations for deep and hollow types,⁸⁷⁴ for those with or without an application of pitch,⁸⁷⁵ and for types fully fired,⁸⁷⁶ an indication perhaps, along with the requirement for newness, that clay vessels used in medicine were not always of high quality. In two remarkable instances Oribasius requires an *angeion* shaped like a *kribanos* or *klibanos*; that is, one “narrow and pipe-shaped above” or “shaped like a bread pan, spherical and narrow above” and “with an opening below.”⁸⁷⁷ Also noticeable in contrast to the *skeuos* is the fact

864 Galen, *Cmpds. by Kind* 13.1041K.

865 Galen, *Cmpds. by Kind* 13.1044K [Heras]; Aëtius 12.55.35.

866 Paul 3.1.6: ἕα βρέχεσθαι ἐν ἀγγείῳ ὕαλῳ.

867 Galen, *Cmpds. by Place* 12.631K: ὁμοῦ ἐν ὑελίνῳ ἀγγείῳ ἐπὶ θερμοσποδιδας θέρμαινε.

868 Galen, *Cmpds. by Place* 13.119K: τηκέσθω δὲ ἐν ἀγγείῳ διπλῷ.

869 Paul 3.1.4: φρύγε ἐν ἀγγείῳ ὀστρακίνῳ; Aëtius 2.120.19: βάλλων ἐν ἀγγείῳ κεραμεῖω τίθει ἐν ἡλίῳ.

870 Dioscorides, *Mat. Med.* 5.99.3: δεῖ δὲ ἐν κεραμεῷ ἀγγείῳ κατορύσσειν ἐν κοπρίᾳ ἐν τοῖς ὑπὸ Κύνα καύμασιν ἡμέρας τεσσαράκοντα. Copied by Oribasius, *Coll. Med.* 13.chi.6.

871 Oribasius, *Coll. Med.* 12.nu.2: φύλασσε ἐν ὀστρακίνῳ ἀγγείῳ καὶ πωμάζων εὐμελῶς.

872 Galen, *Cmpds. by Place* 13.218K: ἐψήσας ἐν καὶνῷ ἀγγείῳ; Dioscorides, *Mat. Med.* 2.77.2: ἀποτίθεται ἐν ὀστρακίνῳ ἀγγείῳ καὶνῷ, ἀποξυσμένης ἐπιμελῶς τῆς ὑποστάθμης. The requirement for new or fresh types applies only to clay models. For the occasional desirability of a shined or tinned model see Aëtius 8.3.3: βαλὼν ἐν ἀγγείῳ γεγανωμένῳ.

873 Galen, *Cmpds. by Place* 13.119K: τηκέσθω δὲ ἐν ἀγγείῳ διπλῷ; Aretaeus, *Care Acute Dis.* 1.6.5: ἐν διπλῷ ἀγγείῳ ἐψηθέν.

874 Aëtius 1.Pr. 282: ἐν ἀγγείῳ κοίλῳ ἐν προσηλίῳ τόπῳ; Aëtius 2.96.14: ἐν βαθυτέρῳ τινὶ ἀγγείῳ.

875 Dioscorides, *Mat. Med.* 5.12.1: ἐν ἀγγείῳ πεπισσωμένῳ; Oribasius, *Coll. Med.* 12.nu.1.line 23: ἐν ἀγγείῳ καὶνῷ ἀκωνήτῳ.

876 Galen, *Maintaining Health* 6.266K: φρυγέσθω μετρίως ἐν ἀγγείῳ κεραμέῳ, τελέως ὡπητημένῳ κατὰ τὴν κάμινον.

877 Oribasius, *Coll. Med.* 11.beta.14: ἄψας καὶ πωμάσας ἀγγείῳ σωληνοειδεῖ στενῷ κατὰ τὸ ἄνωθεν, τρήμα δ' ἐκ τῶν ὑπὸ πόδας ἔχοντι ὥσπερ οἱ κρίβανοι, ἕα καίεσθαι; *Coll. Med.* 12.pi.17: πωμάσας κεραμέῳ ἀγγείῳ κριβανῶδει, ἄνωθεν μὲν περιφερὲ καὶ στενῷ, κάτωθεν δὲ τρήμα ἔχοντι καθάπερ οἱ κλίβανοι, ἕα καίεσθαι.

that many *angeia* are associated with the production of perfumes;⁸⁷⁸ these can be small as well as large in size.⁸⁷⁹ The desirability of diminished size and the fact that *angeia* used for storage are said, with notable frequency, to be made of glass incline one to link the name with the small glass containers found in several instrumentaria recovered from graves (Figg. 86; 89).⁸⁸⁰

In addition to *skeuos*, the name *angeion* also seems sometimes interchangeable with others. For example, though *angeion* and *puxis* are sometimes clearly distinguished,⁸⁸¹ Galen, *Cmpds. by Kind* 13.1056K shows the (at least sometimes) close relationship between them and leaves open the possibility that the names were sometimes equated: “when you; have mixed together all the ingredients named, store (the compound) in a *puxis* or a glass *angeion*.⁸⁸²”

On a very few occasions the name *teuchos* (τεύχος) appears. We learn from Oribasius, who refers to clay and to wide mouthed or open models, that the *teuchos* served to expose and to store.⁸⁸³ The scholia to Nicander, *Alexipharmaca* (315b1, Geymonat) equate it with *angeion*. Galen even appears once to substitute *angeion* for *chutra*, a type of kettle (see below).⁸⁸⁴ Taken altogether the literary sources, though not always particularly detailed, allow for a considerable variety of types under the class *angos/angeion*.

We may also associate with *angeion*, the name βίκος (*bikos*). It too was compared/identified by scholiasts and grammarians with other types of vessels of various sizes, including small ones appropriate for perfume.⁸⁸⁵ Those used for storage in medicine/pharmacy seem to have been relatively small

878 Galen, *Cmpds. by Place* 13.54K (δισυλίζομεν εἰς ἕτερον ἀγγεῖον μυρεψικόν), *Cmpds. by Place* 13.55K (εἰς κυρτίδα βαλόντες ἐκθλίβομεν τὸ ὑγρὸν εἰς ἕτερον ἀγγεῖον μυρεψικόν), *Cmpds. by Kind* 13.1028K (βαλόντες εἰς ἄγγος διπλοῦν μυρεψικόν), *Cmpds. by Kind* 13.1043K (βαλὼν εἰς μικρὸν ἀγγεῖον μυρεψικὸν κασσιτέρεινον [Heras]), and Aëtius 12.55.25 (ἔστω δὲ τὸ ἀγγεῖον μυρεψικὸν κασσιτέρεινον).

879 For large see Dioscorides, *Mat. Med.* 5.7.2 (σκευάζειν δὲ δεῖ ἐν μεγάλῳ ἀγγεῖῳ, ἵνα τόπον ἔχη πρὸς τὸ ὑπερζειν...); for small, Aëtius 6.58.5 (ἔψε ἐν ἐτέρῳ ἀγγεῖῳ μικρῷ); for four times as large Aëtius 1.343.2 (τετραπλασίονι ἀγγεῖῳ).

880 Künzl (1983a): 46(13.2); 89(66); 92(70–72); 94(74). Some of these pieces are quite fine, reminding one of Archigenes' recommendation ἀπόθου ἐν ἀγγεῖῳ ὑελίνῳ καλῷ; see C. Brescia, *Frammenti medicinali di Archigene* (Naples, 1955) 11.

881 Galen, *Cmpds. by Place* 12.738K: ἔψε ἐν ἀγγεῖῳ χαλκῷ καὶ ἀπόθου εἰς πυξίδα χαλκῇν...

882 οὕτως δ' ἐνώσας πάντα τὰ προειρημένα, εἰς πυξίδ' ἀπόθου ἢ εἰς ὑελιοῦν ἀγγεῖον.

883 *Coll. Med.* 5.4.2: ἐξαιθριάζων ἐν ἀχανεῖ τεύχει καὶ διαχέων εἰς τεύχη πολλὰ...; *Ecl. Med.* 11.2: ἀποτίθεσο δ' ἐν κεραμιαίῳ τεύχει.

884 Galen, *Cmpds. by Place* 12.517K: χρῆ δὲ ἔψιν αὐτὰ κατὰ χύτραν καινὴν... εἴτα κρεμάσαντας ἐν τῷ ἀγγεῖῳ...

885 See E. Saglio in Daremberg-Saglio, *Dict. des antiquités grecques et romaines, etc.* 1/1.711.

(the diminutive *bikion* occurs often enough) and made mostly of glass.⁸⁸⁶ They might have a narrow or wide mouth, and the fact that that they might be covered/bunged with linen cloth also hints at generally small size.⁸⁸⁷

Latin terms, aside from *pyxis*, are found abundantly in Scribonius Largus and Marcellus Empiricus. Used for storage, cooking, maceration and mixing of medications these vessels too are described as being of glass, copper, lead, silver, silver-lead alloy and clay. In addition they are often said to be closed (*clausa-um*) and sealed/labeled (*sub signaculo*) as to their contents. Names include *ampulla*, *dolium/doliolum* (equated with *bikion* by *Herm. Mon.* 207.46) and *vas/vasculum*.⁸⁸⁸ These were surely the equivalent of the Greek terms and, like them, were coupled with *pyxis*. A few of many examples from Marcellus:

You will store (the medication) under seal in a boxwood *pyxis* or in a glass *doliolum* . . .

Or again,

These ingredients are to be kept steeping with must and oil for 30 days in a silver alloy or clay *vas*.⁸⁸⁹

One last term to consider is *κυλιχνίς* (*kulichnis*) and its variants *κυλίχνη*/*κυλίχνιον*. *Kulichnis*, which does not appear on *Lists*, designated various types

886 Dioscorides, *Mat. Med.* 2.78.1 (βάλε εις βίκον ὑέλινον καὶ . . . ἀπόθου); Aëtius 7.101.14 (βίκον ἄμπουλλαν ὑελίνην πλήσας ἐλαίου); Paul 7.20.33.25 (κατάγγιζε ἐν βικίοις ὑελοῖς); *Hippiatrica Ber.* 11.22.4–5 (ἀποτίθει εις βικίον ὑέλινον, καὶ ἐν καιρῷ χρείας ὑπάλειψε). There is one reference to tin; *Hippiatrica Ber.* 11.38.3: ἀνελόμενος εις βικίον ὑάλινον ἢ κασσιτέρεινον ἔγχριε.

887 For the mouth, see Erotian, *Hippocratic Glossary* 59.3 (βικίου εἶδος στενοστόμου) in contrast with Paul 7.21.2.6 (συνθές εις βίκον πλατύστομον). For plug/covering, see Dioscorides, *Mat. Med.* 2.78.1: τὴν ἀρχὴν τοῦ λίνου περιδήσας τῷ στόματι τοῦ βίκου πωμάσας ἀπόθου; Aëtius 1.113.4: περιστρίγγειν χρὴ τὸ στόμα τοῦ βίκου ἔσωθεν μὲν ὀθονίῳ.

888 Scribonius Largus seldom uses *dolium*, never *vasculum*. Most references to *vas* in Marcellus are for vessels used for cooking and macerating medications.

889 *De Med.*: 20.92 (*recondes sub signaculo in pyxide buxæ aut in doliolo vitreo*), 35.7 (*haec cum musto et olio macerantur in vaso stagneo aut fictili posita per dies xxx*). A few other passages in *De Med.*: 8.23 (*repones in ampulla vitrea vel cyprea*), 9.58 (*reponuntur in pyxide cyprea aut in doliolo vitreo*), 20.88 (*haec omnia in pulverem redacta reponuntur in doliolo vitreo signato*), 29.15 (*in doliolo vitreo condetur*), 35.23 (*in doliolum vitreum aut pyxidem stagneam recondes*), 1.106 (*in vasculo vitreo aut fictile sub signaculo reponatur*), 11.36 (*in vasculo aereo aut vitreo costodiuntur*), 7.11 (*in vasculo plumbeo diligenter clauso maceratur*), 35.10 (*in pyxide stagneæ aut in vasculo plumbeo reponatur*).

of containers, including those used by physicians. We first find it in medical contexts in Old and Middle Comedy and among the dedications recorded for the Athenian Asklepieion.⁸⁹⁰ Assuming the nonsensical κυγχνίδα in Galen's *Hippocratic Glossary* is a corruption of *kulichnis*, the name also occurred in some lost portion of the *Hippocratic Corpus*. In that case, Galen offered the definition "the small cup (*kulix*) or the doctors *pithakne*" (see below, s.v.).⁸⁹¹ Athenaeus, however, equated *kulichnis* with "the doctor's *puxis* owing to its having been turned on a lathe" (*Deip.* 11.480c; see also *Hsch.* Kappa 4503 and 4).⁸⁹² In contrast, the 2nd century grammarian Herodian saw the doctor's *kulichne* as a *phiale*, a flatter, open vessel.⁸⁹³ The fact that Imperial authorities could not settle on one defining term indicates that a medical *kulichnis* assumed a number of shapes.⁸⁹⁴

Cooking Pots

The following names occur more in the context of cooking and heating various preparations.

We come first to *kakkabos* (κακ(κ)άβη-ος, dim. κακκάβιον, transliterated *caccabus* in Latin sources) and to the Latin term *olla*. Passages from the *Compositiones* of Scribonius Largus are sufficiently illustrative.

The lung of a fox reduced to ashes in a new clay *olla* has been of benefit to many... (*profuit multis pulmo vulpis in olla fictili ad cinerem redactus*... 76).

And again,

Let the medicine be combined in a new clay *caccabus* and cooked over a mild fire... " (*medicamentum coniciatur in novo fictili caccabo et coquatur pruna non nimis acri*... 220).

890 Aristophanes *Eq.* 906 and schol. (repeated by Suda, kappa.2668); Antiphanes Fr. 206 (*Poetae Comici Graeci*); For the Asclepieum inventories of 244/3 BCE, see Aleshire (1989) 44.

891 19.115K

892 Ἀθηναῖοι δὲ καὶ τὴν ἰατρικὴν πυξίδα καλοῦσι κυλινθίδα διὰ τὸ τῷ τορνῷ κεκυλίσθαι.

893 περὶ ὀρθογραφίας (in *Grammatici Graeci*, ed. Lentz, vol. 3.2, 456.8); κυλίνθη σημαίνει δὲ φιάλην ἰατρικὴν.

894 For a broader discussion of the sources for *kulichnis* and its variants see M.J. Milne (1939) and M.G. Kanowski (1984) 76–77.

As to appearance, it would seem that the *kakkabos* was basically a squat kettle.⁸⁹⁵ Copper alloy and clay models are mentioned as well as ones that are polished, new, and crude/rough.⁸⁹⁶ A 'Bronzkessel' in the instrumentarium of the 'Surgeon of Paris' may represent the type (Fig. 90).⁸⁹⁷ The name *olla*, which is peculiar to Latin treatises, must have resembled the amphora-like ash containers of that name so common in Roman *columbaria* and burials.⁸⁹⁸ The types used for pharmacy were likely less refined. They are often described as 'rough/crude' and, as one might expect, they clearly differed in size.⁸⁹⁹ Only fictile types are attested in the sources (as in the citations above).⁹⁰⁰ One such was taken from a grave at Rheims with collyrium stamps and *puxides* (Fig. 88).⁹⁰¹ Both the *kakkabos* and the *olla* could be covered.⁹⁰²

The *kakkabos* is explicitly equated in the literature with the χύτρα/*chutra* (cooking pot), a common household article.⁹⁰³ In pharmaceutical texts, the *chutra* (occasionally κύθρα)⁹⁰⁴ is probably mentioned more frequently than any other container, for heating various concoctions. Like the *kakkabos* and the *olla* it is generally made of clay,⁹⁰⁵ sometimes required to be new, or

-
- 895 E. Saglio (Daremberg-Saglio, *Dict. des antiquites grecques et romaines, etc.* 1/2.774) sees it as positioned on a three-legged trivet, based on a specimen he so identifies from Pompeii.
- 896 *Hippiat., Ex. Lugd.* 81.3 (βάλλε εἰς χαλκοῦν κακκάβιον...); Pseudo-Galen, *Drugs Easily Procured* 14.548K (βαλὼν ἐν κακκαβίῳ γανωτῷ ἢ ἐν χύτρᾳ...); Aëtius 15.46.17 (κατάρχεε εἰς κάκκαβον καὶνὸν καὶ ἔψε...); Marcellus Empiricus, *De Med.* 22.31 (*in olla vel caccabo rudi*). The *rudis* nature of some models fits with their being on occasion punctured to evacuate their contents (Scribonius Largus, *Comp.* 271 = Marcellus, *De Med.* 35.9).
- 897 Künzl (1983a) 75(49.1).
- 898 Cf. E. Pottier in Daremberg-Saglio, *Dict. des antiquites grecques et romaines, etc.* IV/1 171.
- 899 Marcellus Empiricus, *De Med.* 5.16, 7.6, et passim (*in ollam rudem mittes*); 20.84 (*in ollam grandem*).
- 900 Once specifically of the potsherd lime mixture produced at Signia in Latium: Scribonius Largus, *Comp.* 104 (various fruits *Segnina olla reposita*).
- 901 Cf. Künzl (1983a) 59(27). This specimen apparently contained the ashes of the deceased but it is basically representative of the type.
- 902 Scribonius Largus, *Comp.* 122: *olla fictili... operculoque superposito*; Oribasius, *Coll. Med.* 5.33.3: πωμάσας τὸ κακκάβιον... Cf. also *Coll. Med.* 2.45.6.
- 903 Athenaeus, *Deip.* 4.169c (τὴν χύτραν δ' Ἀριστοφάνης... κακκάβην εἴρηκεν...). Pseudo-Galen, *Drugs Easily Procured* 14.548K, where a polished model is recommended (βαλὼν ἐν κακκαβίῳ γανωτῷ ἢ ἐν χύτρᾳ...); Alexander of Tralles, *Therap.* 2.349.4 (ἐμβαλε τὰς βοτάνας εἰς χύτραν καὶνὴν ἢ εἰς κάκκαβον...).
- 904 Dioscorides, *Mat. Med.* 5.81.5. Another variant is χύτρος: Nicander, *Ther.* 98, *Alex.* 136.
- 905 Galen, *Cmpds. by Place* 12.458K (λαβὼν χύτραν ὀστρακίνην καὶνὴν, πῶμα ἔχουσιν μεγάλην); Oribasius, *Syn.* 3.13.1 (εἰς καὶνὴν χύτραν κεραμίαν ἐμβαλὼν... καὶ τὸ πῶμα πηλῷ περιπλάσας); *Hippiat. Ber.* 4.6.2 (ἐμβαλε εἰς χύτραν ὀστρακίνην). Rarely we find silver and copper/bronze

crude,⁹⁰⁶ or lidded and/or sealed.⁹⁰⁷ It can be large enough to hold a double boiler but, like the *olla*, it could sometimes have a narrow or at least a narrower mouth.⁹⁰⁸ And, like some surviving specimens of the *olla*, it is clear that the *chutra* had a handle/handles: Oribasius, *Coll. Med.* 13.lambda.1.16 (ἀπὸ τοῦ ὠτὸς τῆς χύτρας). This must pretty regularly have been the case if a comedian could call a kiss featuring held ears a *chutra*.⁹⁰⁹ This feature perhaps distinguished it from the *kakkabos*.

In view of the fact that *olla* does not occur as a transliterated term in Greek treatises, but was surely a container used by Greco-Roman physicians and pharmacists of the Empire, it must lurk behind a Greek name. *Chutra* and *kakkabos* come quickly to mind. The same line of reasoning applies to *chutra*, which does not (as opposed to *kakkabos*) occur transliterated in Latin treatises. The point is that these three names are applied to containers often made of the same material and performing similar functions. It seems probable, therefore, that they often were applied indiscriminately to the same objects, a fact noted by observant ancient commentators.⁹¹⁰

Also occurring frequently in the sources is the *lopas* (λοπάς, dim. λοπάδιον). The term is equated by grammarians with the frying pan or *teganon* but, mad-denyingly, equated by the same authorities with the *kakkabos* and the *chutra*.⁹¹¹

required: Galen, *Cmpds. by Kind* 13.879 (εἰς χύτραν χαλκὴν ἐρυθροῦ χλακοῦ); Soranus, *Gyn.* 4.14.4 Ilberg (εἰς χύτραν ἀργυρᾶν ἢ χαλκὴν κασσιτέρῳ περιεχουμένην).

906 Galen, *Cmpds. by Place* 12.438K (πάντα βαλὼν εἰς χύτραν καὶ κινῶν καὶ στόμα ἀργίλῃ περιπλάσας); Aëtius 8.6.52: (βαλὼν εἰς χύτραν καὶ κινῶν); Oribasius, *Coll. Med.* 12.sigma.48 (δὸς εἰς χύτραν κεραμέαν καὶ κινῶν...), *Coll. Med.* 13.lambda.1.line 14 (βαλὼν τε εἰς καὶ κινῶν χύτραν), *Coll. Med.* 13.alpha.5 (εἰς ὠμὴν χύτραν ἔμβαλε), *Coll. Med.* 13.chi.1 (ἐν ὠμῇ χύτρᾳ); Cassius Felix (35.2) *cacabo fictili et novo*, (76.11) *cacabo novo*.

907 Along with citations in the two previous notes see Dioscorides, *Mat. Med.*: 5.109.7 (ἔμβαλε εἰς χύτραν καὶ πωμάσας ὑπόκειται κινῶν), 5.115.1 (ἔμβαλε εἰς χύτραν καὶ κινῶν καὶ σκεπάσας... ῥάκεσιν ἐπιμελῶς ἔασον ἐνταῦθα νύκτα μίαν = Oribasius, *Coll. Med.* 13.alpha.8) and 5.118.4 (εἰς ὠμὴν χύτραν ἔμβαλε καὶ περιελείψας τὸ στόμα αὐτῆς πηλῷ δὸς εἰς κάμινον).

908 Galen, *Cmpds. by Kind* 1055K: βάσταζε τὸ διπλοῦν σκευάριον ἐκ τῆς χύτρας: Galen, *Cmpds. by Place* 12.654K: εἰς χύτραν... καὶ κινῶν στενόστομον...

909 *Poetae Comici Graeci* 5, Eunicius Fr. 1; see also Pollux 10.100.

910 In addition to Athenaeus, *Deip.* 4.169c, see Hesychius, *Lexicon* (A–O) kappa. 313 (ἡ χύτρα, ἦν ἡμεῖς <κάκκαβος> <κάκκαβος> ἢ λοπάς (A). So too E. Saglio in Daremberg-Saglio, *Dict. des antiquités grecques et romaines*, etc. 1/2 1140.

911 For *lopas* as *teganon* (τήγανον) see Suda, *Lexicon* omicron.818 (λοπάς: τὸ τήγανον), lambda.674 (λοπάς: παρὰ Συρακοσίοις τὸ τήγανον: παρὰ δὲ Θεοπόμῳ ἡ σορός...) and Hesychius, *Lexicon* (A–O) lambda.1262. For *lopas* as *kakkabon/chutra*, see Hesychius, *Lexicon* (A–O) kappa. 314 (ἡ χύτρα, ἦν ἡμεῖς <κάκκαβος> <κάκκαβος> ἢ λοπάς [A]); Suda, *Lexicon* lambda.675 (λοπάς: ἡ κύθρα); Aelius Herodianus et Pseudo-Herodianus, *Partitiones*

Nonetheless the *lopas* seems closer to a fry pan or skillet than to a pot.⁹¹² Called a ‘boiling vessel’,⁹¹³ we often find it deployed for drying out or reducing liquids to a honey-like or thick consistency. For this purpose the more open shape of a skillet would be desirable. Here we may cite Galen, *Compds. by Kind* 13.823K:

Put lead monoxide (*litharguros*) with oil into a new clay *lopas* with a wide mouth [and] boil over a light, moderate fire stirring with a spatula (*spathe*) until the thickness is that of Attic honey.⁹¹⁴

Again, in preparing a plaster for abscesses Aëtius remarks (15.18.9–10):

Transfer the mixture to a clay *lopas* and boil over a moderate fire until all the water is used up.⁹¹⁵

In addition to being wide mouthed, we are told that a *lopas* might be large, hollow and smooth, and (sometimes) covered.⁹¹⁶ As with containers, it could be made of clay, copper alloy, and red copper.⁹¹⁷ Frequently new models are pre-

p. 78 (λοπάς, ἡ χύτρα). The terms seem interchangeable at Galen, *Compds. by Kind* 13.779K: ἔψε ἐν λοπάδι μεγάλη... εἶτα ἄρας τὴν χύτραν.

912 The comic poet Plato distinguished the two, but it is unclear how; see *Poetae Comici Graeci* VII, Plato Fr. 189: οὐδὲ λοπάς κακόν ἐστιν· ἀτὰρ τὸ τάγγηρον ἄμεινον, οἶμαι. Galen mentions the *kutos* or ‘hollow of the *lopas*’: *Compds. by Place* 12.891K: ἀποπλήρου τὸ πᾶν κύτος τῆς λοπάδος. As *kutos* is applied to things like the vault of heaven (see *LSJ*), this may mean that the *lopas*, or some versions of it, did not have a flat bottom. We find Dioscorides occasionally calling for a κοίλη/ον or ‘hollow’ model (e.g., *Mat. Med.* 5.88.5), which might reflect whatever *kutos* means.

913 Cf. Hesychius, *Lexicon* (A–O) epsilon. 7705 and 7695: ἐψητήριον: ἡ λοπάς.

914 λιθάργυρον δὲ μετ’ ἐλαίου βαλὼν εἰς λοπάδα καὶνὴν κεραμίαν πλατύστομον ἔψε πυρὶ κούφῳ καὶ μαλακῷ κινῶν σπαθῇ, ἕως γένηται μέλιτος Ἀττικοῦ πάχος.

915 καὶ ἀναλαβὼν εἰς λοπάδα ὀστρακίνην, ἔψε μαλακῷ πυρὶ, ἕως διαπανθῇ τὸ ὕδωρ ὅλον. Cf. Galen, *Properties of Foods* 6.529 and 6.667K (the latter copied by Oribasius, *Coll. Med.* 3.33.5); Alexander of Tralles, *Therap.* 2.467.24–25.

916 E.g., Galen, *Antidotes* 14.199K (εἰς λοπάδα καὶνὴν εὐμεγέθη προσέμβαλε) and *Compds. by Kind* 13.779K (ἔψε ἐν λοπάδι μεγάλῃ). Dioscorides, *Mat. Med.* 5.88.5 (εἰς λοπάδα κοίλῃν λείον ἀπόδος). For covering see *Comica Adespota* (CAF), *Fragmenta incertorum poetarum in Comicorum Atticorum fragmenta*, vol. 3 (Kock) fr. 651.2: εὐρεν ἡ λοπάς τὸ πῶμα.

917 Dioscorides, *Mat. Med.* 5.87.12: εἰς λοπάδα καὶνὴν κεραμεᾶν; Galen, *Compds. by Kind* 13.819K: τὴν ῥητίνην βαλὼν εἰς λοπάδα ὀστρακίνην [Philoxenus]; Galen, *Compds. by Place* 13.249K: τὸν ἰξὸν ἔψε βαλὼν εἰς λοπάδα χαλκῇν; Galen, *Simples* 12.356–357K (copied by Aëtius 2.175.13–14): λοπάς ἐξ ἐρυθροῦ χαλκοῦ...

scribed; these are fictile when their material makeup is specified.⁹¹⁸ Like the *chutra*, another vessel can be positioned in the *lopas* in various preparations, or placed under it.⁹¹⁹ Usually, the *lopas* is positioned over coals, but we also find it placed in sunlight for purposes of dessication, sometimes at a specific season. So Dioscorides in the various preparations of *litharge* (lead monoxide):

... when you have poured it into a new clay *lopas*, the water being gently filtered off, place it in the sun for 40 days at the time of the Dog Star, dry and use.⁹²⁰

Through similarity of function, pharmaceutical writers in Latin prompt us to associate the Greek *lopas* with the Roman *patella*, and (rarely) *patina*. Like the *lopas* the *patella* is used to reduce liquids, is set over coals, comes in clay and copper models (once even in iron), and sometimes is required to be new (of clay, when specified).⁹²¹ A close parallel occurs when Marcellus Empiricus and Alexander of Tralles both offer a preparation of goat's blood for urinary problems: the former reducing it in a hot iron *patella*, the latter in a *lopas*.⁹²²

918 E.g., Galen, *Cmpds. by Kind* 13.920K: εἰς λοπάδα καινήν; Dioscorides, *Mat. Med.* 5.87.12 (preparing litharge): εἰς λοπάδα κεραμεῶν καινήν; Dioscorides, *Mat. Med.* 1.68.7 (preparing soot): ἐπιτίθει εἰς κοῖλον λοπάδιον ὀστράκινον καινόν.

919 Dioscorides, *Mat. Med.* 5.95.1 (preparing quicksilver from cinnabar ore [copied by Oribasius, *Coll. Med.* 13.upsilon.1]): θέντες γάρ ἐπὶ λοπάδος κεραμεᾶς κόγχον σιδηροῦν ἔχοντα κιννάβαρι... Dioscorides, *Mat. Med.* 1.68.4 (preparing frankincense): ἔνιοι δὲ καὶ περιτιθέασιν τῷ λοπάδιῳ ἀγγεῖον χαλκοῦν κοῖλον κατατετρημένον μέσον...; Oribasius, *Coll. Med.* 8.43.2 and *Syn.* 3.211.2 (preparing purge of lykos): ἐγκαθίσταται τὸ ἀγγεῖον τοῦτο λοπάδι ἐρεγμοῦ πλήρει.

920 *Mat. Med.* 5.87.12: ... κατεράσας αὐτὴν εἰς λοπάδα κεραμεῶν καινήν, ἀπηθήμενου παντὸς πρῶως τοῦ ὕγρου, θές ἐν ἡλίῳ ἐπὶ ἡμέρας τεσσαράκοντα ὑπὸ Κύνᾳ καὶ ξηρᾶνας χρῶ. For a recipe similarly prepared under the Dog Star but in the sign of the Lion and on the 18th of the month, see Oribasius, *Eunap.* 3.72.1 (drawing on Galen, *Simples* 12.356–357K).

921 Scribonius Largus, *Comp.* 37 (for collyrium): *deinde in patella aeris Cypri super carbones posita infervescit, donec mellis habeat non nimium liquidi spissitudinem* (cf. also 228, preparation for warts, hemorrhoids etc.); 57 (for loose teeth): *haec misceri oportet mortario, deinde patella fictili fervefacere, ut spissentur* (= Marcellus Emp., *De. Med.* 12.4); 267 (plaster for gout): *patella nova liquifit axungia* (= Marcellus Emp., *De. Med.* 35.5). Marcellus Emp., *De. Med.* 19.11 (preparation for impetigo): ... *in patina decoque* ... and 27.8 (preparation for disorders of digestive system): *tum in patellam fictilem novam mel infunditur tapectum molli pruna* ...

922 Marcellus, *De. Med.* 26.95: *Sanguis hircinus ... excipitur in patella ferrea candente ut aduri possit et stringi continuo ipse sanguis ita ut postea in pulverem redigatur* ...; Alexander

I know of no readily recognizeable *lopas/patella* recovered with surgical instruments. However, metal ‘skillets’ recovered at Pompeii may represent versions produced during the Empire.⁹²³ These are oblong, in keeping with E. Pottier’s view that the *lopas* was “de forme oblongue”, based in part on his interpretation of an entry in the Byzantine lexicon, *Suda*. There we find the *lopas* equated with the oblong *soros* or sarcophagus.⁹²⁴

Into this nexus of ambiguity we may place another Greek word for kettle, which is not transliterated in Latin sources: *lebes*.⁹²⁵ The *lebes* is likewise employed mainly for brewing up concoctions, as in a recipe recorded by Galen for relief of arthritic pain:

As to whole foxes being boiled up in olive oil, some treat arthritics this way. Some toss the foxes alive into a very large *lebes*, others when they are dead . . . (*Simples* 12.367K).⁹²⁶

As to the appearance of the *lebes* little can be extracted from the pharmaceutical sources other than a preference for large size (as above).⁹²⁷ Only Dioscorides (*Mat. Med.* 1.30.5 & 1.32.1) mentions a tin-plated model with a flat rim (εἰς λέβητα κεκασσιτερωμένον πλατύστομον ἐγγέας). Galen’s call in *Theriac to Piso* 14.266K for a polished *lebes* (εἰς λέβητα γεγανωμένον καλῶς) means there were likely other metal versions in addition to tin. When cited in lay literature by later commentators and lexicographers, the *lebes* is compared to a tripod, said to be three legged, and equated with the *chutra*.⁹²⁸

Trall., *Therap.* 2.467.22–28: καὶ ἐάσας παγῆναι (goat’s blood) κατάρτεμε εἰς λεπτὰ μόνον ἐν τῇ λοπάδι.

923 Johnston (1957) 228.

924 See his entry in *Daremberg-Saglio, Dict. des antiquites grecques et romaines, etc.* III/2 1301 with the *Suda, Lexicon* lambda.674 (λοπάς· παρὰ Συρακοσίοις τὸ τήγανον· παρὰ δὲ Θεοπόμῳ ἡ σορός . . .).

925 For the various shapes associated with the *lebes*, see Kanowski (1984) 86–87.

926 περὶ δὲ τῶν ὄλων ἐν ἐλαίῳ καθεισόμενων ἄλωπέκων, οὕτως γάρ τινες ἀρθριτικούς θεραπεύουσιν, οἱ μὲν ζώσας ἐμβάλλοντες μεγίστῳ λέβητι τὰς ἄλωπεκας, οἱ δὲ καὶ τεθνεώσας . . . The recipe is reproduced by Oribasius, *Syn.* 9.57.4, Aëtius 12.63.147 and Paul 3.78.23 where hyenas are thrown in, and other maladies treated with the resultant oil as well.

927 Sometimes a smaller vessel was placed in the *lebes* in a process called ‘boiling in two vessels’ (ἐψησις ἐν ἀγγείοις διπλοῖς): see Galen, *Maint. Health* 6.289–90K, *Compds. by Place* 13.37K.

928 Hesychius, *Lexicon* (Π-Ω) tau.1417, <τρίποδα>· λέβητα τρισκελῇ. *Scholia In Aristophanem, Scholia in Equites* (scholia vetera et recentiora Triclinii) Argumentum-dramatis personae-scholion sch eq, section-verse 921d, line 1 (ὑπερζέοντος καὶ παφλάζοντος τοῦ λέβητος ἢ τῆς

Also functionally equated with the *chutra* is the much less frequently cited *gastra* (γάστρα).⁹²⁹ Its name indicates that the distinguishing feature of the *gastra* was a broad belly, in form perhaps something along the lines of Figg. 87 or 91. Dioscorides deploys clay types of this vessel to render white lead and a faux hematite, allowing also for a flat or broad-mouthed *pithakne* in rendering the former (εἰς πιθάκνην πλατύστομον ἢ κεραμεῶν γάστραν).⁹³⁰ The *pithakne* too is infrequently found in the surgical literature. In his *Hippocratic Glossary*, Galen defines the Hippocratic *kunchnis* (= *kulichnis*) as “a small cup and the doctor’s *pithakne*” (19.115K: τὴν τε μικρὰν κύλικα καὶ τὴν ἰατρικὴν πιθάκνην). This points to an open cuplike form. In addition to white lead, Dioscorides also makes verdigris and palm wine in the *pithakne*, and Galen records the use of long models (εἰς πιθάκνας μικράς) in producing a secondary wine.⁹³¹ There would seem then to have been two types: a cuplike model and a longer, perhaps bellied, *pethakne*. In the two testimonia to wine production the *pithakne* features an opening at its base stoppered with a pitch covered reed reinforced with linen.⁹³² The plug, therefore, may have been a regular feature in types used for steeping/fermenting. As Galen’s long versions could become completely saturated by their contents (ὥς διαβρόχους ἀπάσας γενέσθαι), they must have been fictile.

Instruments for Stirring

There are numerous references to a spatule or spatula used for mixing and stirring various concoctions in the pots treated above. It was generally called by Greeks σπάθη or σπάθα (*spathe*, *spatha*), terms simply transliterated by Latin authors who also sometimes write *spatula*.⁹³³ As to material composition, the majority of references are to wood,⁹³⁴ and most often to specific types of

χύτρας). As with the *chutra*, Galen once desires a new one: *Cmpds. by Place* 13.42K (εἰς λέβητα καινόν).

929 *Scholia in Nicandri Theriaca*, 106b: *γάστρη· ἀγγεῖω *K²bd* χύτρα *f* (Crugnola, p. 73).

930 Dioscorides, *Mat. Med.* 5.88.1 (copied by Oribasius, *Coll. Med.* 13.psi.1); Dioscorides, *Mat. Med.* 5.126.3 (copied by Oribasius, *Coll. Med.* 13.lambda.5). See also Aëtius 15.15.416 for the role of several in creating a plaster of resin and other ingredients (ῥητίνης τῆς ἐν ταῖς γάστραις τῆς ξυλώδους διηθημένης λίτραι α, ...).

931 Dioscorides, *Mat. Med.* 5.79.1 (copied in Oribasius, *Coll. Med.* 13.iota.2), *Mat. Med.* 5.31.1; Galen, *Properties of Foods* 6.58oK.

932 To quote Dioscorides, *Mat. Med.* 5.31.1: ... βάλε εἰς πιθάκνην τετρημένην πρὸς τῷ πυθμένι καὶ ἐνεσφραγισμένην καλὰ μω πεπισσωμένω· τὸ δὲ τρήμα λίνω βεβύσθω.

933 Marcellus Emp., *De. Med.* 15.95: ... *movere spatula medicamentum* ...

934 Galen, *Cmpds. by Kind* 13.885 [Andromachus]: καινὼν σπάθη ξυλίνῃ.

wood. These include boxwood,⁹³⁵ pine,⁹³⁶ date palm⁹³⁷ and cypress.⁹³⁸ The *spathe* may have been a crude production, as once a date palm spatle is simply referred to as “a piece of palm wood” (Galen, *Cmpds. by Kind* 13.378: κινῶν ξύλῳ φοίνικος). And, again, there is no need to think the types used in medicine differed from those in common use. In fact, the *spathe* used by perfumers is recommended for several pharmaceutical preparations.⁹³⁹

Wooden specimens would have been biodegradable; hence the reason for no certain survival of wood (though see the ‘tourniquet’ from Plemmirio above). We do once hear of iron,⁹⁴⁰ which allows for metal models like the large crude spatulas of copper alloy now in the Naples Museum.⁹⁴¹

In one case a *spathe* is replaced during a stirring operation with a pestle.⁹⁴² In place of the *spathe* we rarely also find a *rhabdos* (ῥάβδος) or ‘rod’ used for this purpose. This may be no more than a twig or small branch. So we gather from a preparation for a plaster called *phoinike* where Paul stirs the mixture with ‘*rhabdoi* of the date palm’, most likely just the twigs, their byproducts serving as a defining ingredient.⁹⁴³ And in a recipe for ‘The Tooth powder of Timocrates’ recorded by Galen the ingredients are cooked in a covered *chutra* with a hole in its lid. The hole precludes use of a spatle, so a *rhabdos* tempered over charcoal is inserted for stirring, again probably merely a twig or shoot.⁹⁴⁴ Dioscorides (*Mat. Med.* 5.88.5) and Paul (1.87.1) sometimes stir with the stalk of the giant fennel (νάρθηξ),⁹⁴⁵ Galen with a sprig of rue (κλωνίῳ πηγάνου: *Cmpds. by Place* 13.36K). Oribasius refers to something more formal when he recommends a *rhabdos* of red copper to stir a medication for nasal ulcers dried out in

935 Scribonius Largus, *Comp.* 173: *moventurque quae sunt in ea* (sc. *patella*) *diligenter spathe fraxinea*.

936 Galen, *Cmpds. by Place* 12.859 & 862K; Galen, *Cmpds. by Kind* 13.781, 788, 812K (κινῶν σπάθῃ δαδίνῃ), *Cmpds. by Kind* 13.999K (κινῶν σπάθῃ, βέλτιον ἂν ἢ τῇ πευκινῇ); Oribasius, *Eunap.* 4.60.1; Aëtius 15.13.281, 15.14.157, 15.15.128 & 336, 16.48.36; Paul 3.1.6.

937 Oribasius, *Syn.* 3.5.2, *Eunap.* 4.124.2 (ἐψε κινῶν σπάθῃ φοινικίνῃ); Paul 7.20.30.5 & 7.33.12–13.

938 Oribasius, *Ecl. Med.* 136.1, *Syn.* 3.26.3 & 3.39.7; Paul 3.35.2: (ἐψεται κινούμενα κυπαρισσίνῃ σπάθῃ).

939 Scribonius Largus, *Comp.* 269 (*spathe qua unguentarii utuntur*); Galen, *Cmpds. by Kind* 13.1044K = Aëtius 12.55.31 & 15.13.153 (σάλευε σπάθῃ μυρεψικῇ).

940 Galen, *Cmpds. by Kind* 13.440K: κινῶν σιδηρᾷ σπάθῃ ἐπιμελῶς.

941 Bliquez, Jackson (1994) 144(143–144).

942 Galen, *Cmpds. by Kind* 13.693K: κινούντα σφοδρῶς, τὰ μὲν πρῶτα τῇ σπάθῃ, τῷ δοίδουκι δ’ ὀλίγον ὕστερον.

943 Paul 7.17.29.7: σπαθίζων ταῖς τῶν φοινίκων ῥάβδοις.

944 Galen, *Cmpds. by Place* 12.887K: τὸ δὲ πῶμα... κατὰ μέσον τρήμα ἔχον, δι’ οὗ κινείσθω ῥάβδῳ ἐξ ἀνθρακιάς ὠπτημένῳ. Copied by Aëtius 8.37.73–86.

945 Paul prefers a smooth fine one: νάρθηκι λείῳ καὶ λεπτῷ.

a *skeuos* of the same metal.⁹⁴⁶ This combination is reminiscent of mortar and pestle sets made of the same metals (see above).

Some cylindrical containers and medicine boxes come with rods of copper alloy, and sites like Augst have yielded others of that metal as well as glass and bone ('Salbenreiber' 'Reibstäbchen').⁹⁴⁷ The wooden 'tourniquet' taken from the sea near Plemmirio also comes to mind.⁹⁴⁸ All these shafts may have been used for stirring various concoctions in addition to serving other functions.

Basins/Tubs

There are a number of testimonia to common household basins/dishes, as equipment basic to the surgery or at least conveniently available. These are nicely listed together by Galen in his comments to the Hippocratic treatise *In the Surgery* and include the πύελος (*puelos*), the σκάφη (*skaphe*) and the λεκάνη (*lekane*, dim. λεκάν-ιον/ίδιον).⁹⁴⁹ The *skaphe* and *puelos* were primarily tubs for cleansing/soaking body and limbs with water and oils, having served as such since the Hippocratics.⁹⁵⁰ We may cite as one of many examples Galen's treatment of the son of Cercullius who suffered from inflammation and swelling of the thigh.

So I bathed his thigh with oil, seating the boy in a deep *skaphe* holding an abundance of the oil of Sabinus.⁹⁵¹

Other than stipulations as to size, we have little further information about the *skaphe* in surgical use.⁹⁵² In contrast, more abundant testimonia to the *puelos* reveal that, in addition to soaking the body in whole or in part to relieve conditions like gout or arthritis,⁹⁵³ it might also be used to promote postsurgical

946 *Ecl. Med.* 11.2.5: βάλλων εἰς σκευὸς ἐρυθροῦ χαλκοῦ . . . κινῶν ῥαβδῷ ἐρυθροῦ χαλκοῦ . . .

947 Künzl (2002b) Taff. 38–40; Riha (1986) 38–43.

948 Gibbons (1989).

949 18b.671K. Also included is the τροχός: a round vessel to judge by its name, perhaps a wash-basin. The *puelos* is included in *Lists*: Schoene (1903) 283; Bliquez (1984) 197 & 202.

950 See, e.g., [Hippocrates], *Diseases* 3.14 (ileus). Two other vessels are mentioned, once each, and without descriptive detail, for bathing: the τῖτις (Alexander of Tralles, *Therap.* 2.347.8) and the βούττη (Aëtius 3.134.40).

951 διὸ κατῆλουν ἐλαίῳ τὸν μηρὸν ἐν σκάφῃ καθίζων βαθεῖα τὸ παιδάριον, ἐχούσῃ πλῆθος ἐλαίου τοῦ Σαβίνου (*Glaucon Meth. Healing* 11.105–106K, copied by Oribasius, *Coll. Med.* 44.27.9).

952 Alexander of Tralles, *Fevers* 1.327.13–15, shows that the *skaphe* could be large enough to allow for submersion of the entire body. In Soranus we find some models used as a baby's crib: *Gyn.* 2.16.2, 2.37.6, 2.40.4 Ilberg = 2.7.17, 13.50, 13.146 BGM.

953 Galen, *Simples* 12.368K; Oribasius, *Coll. Med.* 10.1.13, 14 & 20 and *Syn.* 9.57.4 [Galen].

healing.⁹⁵⁴ Rarely medicament was prepared in a *puelos*.⁹⁵⁵ The materials mentioned are stone, wood and clay tiles; some types are said to be ‘square’.⁹⁵⁶ Celsus recommends soaking the patient in a tub called *solium* after surgery for bladder stone (7.26.5C). *Solium* then is the Latin equivalent.⁹⁵⁷

There are frequent references to the common all-purpose bowl or basin called *lekane*.⁹⁵⁸ As in the home, its surgical uses were varied and, often, not particularly attractive. Paul provides a pungent example:

This is how you castrate by compression. Young boys are seated in a *lekane* filled with hot water. Then, when the testicles are softened up, you compress them with your fingers in the *lekane* itself until they disappear and, because dissolved, can no longer be felt.⁹⁵⁹

One might feed the sick from a *lekane*, or experiment with a newborn goat, or test for a patient’s breathing by the movement of water in a *lekane* placed on the diaphragm.⁹⁶⁰ As we might expect, drugs and plasters were mixed and macerated in the *lekane* and administered from it.⁹⁶¹ We also find it deployed to collect bodily fluids⁹⁶² and the oil and wine used in bathing dislocations and fractures.⁹⁶³ Finally, it might function as a kind of sitzbath for cleansing/fomenting after treatment of menstrual problems and surgery for rectal abscess.⁹⁶⁴

954 Paul 6.65.4.

955 [Dioscorides], *Euporista or Simples* 1.34.1 (kitchen soot); Aëtius 2.77.11 (chalkanthos).

956 Dioscorides, *Mat. Med.* 5.124.3 = Oribasius, *Coll. Med.* 13.lambd4 (πυέλοι ἐκ τοῦ λίθου); Paul 6.65.4 (ἐν πυέλῳ μακρὰ ξυλίνη); Aëtius 2.77.11 (πυέλοις τετραγώνοις ἐκ κεραμίδων γεγονυαίς).

957 For medical applications of the *solium* in other authors, see also Scribonius Largus, *Comp.* 130 (spleen disorder); Marcellus Emp., *De Med.* 23.13 et passim.

958 For speculation on its shapes see Kanowski (1984) 89–93.

959 6.68.1 ὁ μὲν κατὰ θλάσιν οὕτως ἐπιτελεῖται· ἔτι νήπια ὄντα τὰ παιδιά ἐπικαθίζεσθαι εἰς λεκάνη θερμοῦ ὕδατος· ἔπειτα, ὅταν χαλασθῇ τὰ σώματα, ἐν αὐτῇ τῇ λεκάνῃ τοῖς δακτύλοις θλάς τὰ διδυμα, ἕως οὗ ἀφανισθῇ καὶ διαλυθέντα μηκέτι τῇ ἀφῇ συνεστῶτα ὑποπέσῃ.

960 Galen: *Dist. Pulses* 8.843K (feeding barley gruel), *Aff. Parts* 8.443K (goat) & 415 (breathing).

961 Some examples: Dioscorides *Mat. Med.* 4.150.3 = Oribasius, *Coll. Med.* 12.sigma.19 (purgative); Galen, *Cmpds. by Kind* 13.548K (plaster for fractures); Oribasius, *Ecl. Med.* 98.15 (powder for wounds, sores); Dioscorides, *Mat. Med.* 5.75.8 = Oribasius, *Coll. Med.* 13.pi.1 (zinc oxide); Oribasius, *Ecl. Med.* 87.13 = Aëtius 15.24.2 (plaster for injured sinews, etc.).

962 Galen: *Black Bile*, 5.146K (dropsy), *Aff. Parts* 8.362K (bloody fluid), *Properties of Med. for Purging* 11.334K (humors).

963 Galen, *Shoulder Dislocation in Ways not Seen by Hipp.* 18a.402K = Oribasius, *Coll. Med.* 47.3.7; Galen, *Comm. Hipp. Fractures* 18b.568K = Oribasius, *Coll. Med.* 46.1.122.

964 Soranus, *Gyn.* 3.14.2 Ilberg = 3.2.234 BGM (post menstrual bathing); Oribasius, *Coll. Med.* 44.11.5 (rectal abscess).

As clay is several times specified, the *lekane* may have also come in other materials like wood; it certainly came in different sizes, as indicated by its diminutive forms and the occasional call for a quite large one.⁹⁶⁵

Fumigation and Warming Devices

We have seen fumigation prescribed in the *Hippocratic Corpus* for a variety of uterine conditions (See Hippocratic Surgeries and Surgical Tools s.v. Tubes). The procedure and the devices to execute it, reappear in more or less the same language for similar gynecological conditions in the Empire. Required gear included a chair (δίφρος, *sella*), preferably a midwife's chair (μαιωτικὸς δίφρος), positioned over a covered vessel/pot (χύτρα, *scutra*)⁹⁶⁶ filled with appropriate smoldering substances, these often introduced by a tube (αὐλίσκος, *calamus*) passed into the genitalia.

Examples:

Removal of the placenta by fumigating through a copper vessel lined with tin and attached to an *auliskos* (Soranus, *Gyn.* 4.14.4 Ilberg [Strato], rejected by Soranus).

Removal of the placenta by fumigating the patient with aromatics in a pot (χύτρα) while seated on a chair (δίφρος) and wrapped tightly in clothing (Aëtius: 16.24.25–31 [Philumenus], followed by Paul 6.75.2).

Hysterical suffocation and uterine prolapse, etc., treated by fumigating the patient while tightly wrapped in clothing and seated on the midwife's chair (ἐπὶ μαιωτικοῦ δίφρου). In the case of prolapse alone the patient is fumigated while seated on the midwife's chair through a smooth/soft lead tube (μολυβδοῦν σωλήνιον λείον) attached to one end of a *κάλαμος*, the other end being inserted tightly in a new pot with a *πῶμα ξύλινον*, i.e. a wooden cover (Oribasius, *Coll. Med.* 10.19.2–5 [Antyllus]).

Inducing menstruation by fumigating the patient through a pot (χύτρα) and tube (κάλαμος) while seated ἐπὶ δίφρου (Aëtius 16.53.24–27).

Fumigation ἐπὶ μαιωτικοῦ δίφρου recommended by Euenor and Euryphon to test for capacity to conceive is disapproved of by Soranus (*Gyn.* 1.35.3 Ilberg = 1.11.48 BGM).

965 Galen, *Compds. by Kind* 13.840K & Oribasius, *Ecl. Med.* 98.15 (βάλε εἰς ὀστρακίνην λεκάνην); Soranus, *Gyn.* 3.14. 2 = 3.2.234 BGM (εἰς εὐμεγέθη λεκάνην).

966 The vessels preferred by Hippocratics were a basket or *κάνειον* (*Diseases of Women* 8.11.46L), pots called *χύτρινον* and *ἐχῖνος* (*Diseases of Women* 8.133.39 & 172.7L) and even a gourd (*Diseases of Women* 8.230.8–27L). In their *Hippocratic Glossaries* Galen (19.86K) and Erotian (73.12) both saw in the *echinos* the *chutra* of their time.

Fumigation, etc. to facilitate difficult delivery with parturient properly positioned on birthing chair/*sella* (Aëtius 16.22, Cornarius).

Cato the Elder recommends urine of a person who eats cabbage fired in a pan (*in scutra*) under a pierced chair (*sub sellam pertusam*) to promote timely menstruation (*Agr.* 157.11 [Mazzarino, 2nd ed., 1982]).

Fumigation prescribed without details as to equipment for promotion of conception (Aëtius 16.34.71–72) and prolapse of the uterus (Aëtius 16.71.77–78 [Soranus]).

Pliny mentions, likewise without details, uterine fumigation with ass's spleen and hoof to correct uterine displacement and to abort a dead fetus (*Nat. Hist.* 28.251).

For other than gynecological conditions, the same basic procedure was followed with appropriate adjustments:

For tonsillitis and for earache and hearing problems that arise spontaneously or in the wake of headache the tube (*kalamos*) is inserted into the mouth or the aural canal: Galen, *Comps. by Place* 12.654K [Apollonius] and 12.977K. Alexander of Tralles, *Therap.* 2.85.3–6 and Aëtius 6.80.9 use the same language.

In cases of short breath and excess of phlegm Antyllus covers the patient in clothing and bids him inhale the smoke given off by various substances heated over coals in a *chutra* or small kettle/λεβήτιον (Oribasius, *Coll. Med.* 8.12.3).

In treating a variety of maladies Oribasius recommends inhalation of burning wool: καινῆς χύτρας πληρουμένης ἐξ αὐτῶν (sc. καθαρῶν ἐρίων), εἴτα πωμαζομένης ὅπας πλείονας ἔχοντι τῷ πώματι (*Eunap.* 2.1.epsilon.21).

Steamed concoctions that include realgar and resin are prescribed by Dioscorides for chronic cough (*Mat. Med.* 5.105.2; *Euporista or Simples* 2.35.1). These are to be inhaled orally through a reed siphon (διὰ καλαμίνου σίφωνος) issuing from a perforated cup (ἄμβυκος τετρημένου).

For deafness the same authority favors vapor of brimstone (θείον) applied through a *siphon* (*Mat. Med.* 5.107.3).

The Hippocratic author of *Regimen in Acute Diseases* (2.7.3–5, 7–8 & 15–16L) records a number of ways of administering fomentations. In treating pain in the side he says:

Best of fomentations is hot water in a skin or a bladder or a vessel of copper alloy or clay... Good too is application of a large soft sponge with the hot water squeezed out... And for dry fomentation, salt and toasted millet in small woolen pouches work well.⁹⁶⁷

These 'hot water bottles' are all reflected in later sources, including warmers in the shape of lentils called φακωτὰ πυριατήρια/*phakota puriateria*; the latter are said to be of copper alloy or clay.⁹⁶⁸

Several clay warmers survive in the shape of feet and hands and other body parts.⁹⁶⁹ Filled with hot water or hot water and/or oil these were applied for conditions as diverse as itching pustules, pleutritis and ileus. For other methods of fomentation see Cauteries.

967 θερμασμάτων δὲ κράτιστον μὲν ὕδωρ θερμὸν ἐν ἀσκῷ ἢ ἐν κύστει ἢ ἐν χαλκῷ ἀγγεῖῳ ἢ ἐν ὀστρακίνῳ.... ἀγαθὸν δὲ καὶ σπόγγος μαλθακός, μέγας, ἐξ ὕδατος ἐκπιεσμένος προστίθασθαι... πυρίη δὲ ξηρή, ἄλεις, κέγχροι πεφρυγμένοι ἐν εἰρινέοισι μαρσιππίοισιν ἐπιτηδεύονται.

968 [Hippocrates] *Epidemics* 5.15Smith: ἐθεραπεύετο δὲ χλιάσμασιν ἀσκίοισι...; Celsus 2.17.9Ser: *Quin etiam calido oleo replentur utriculi et in vasa fictilia similitudine quas lentículas vocant, aqua coicitur...*; Soranus, *Gyn.* Ilberg 3.10.3 = BGM 3.2.108: κύστεις θερμὸν ἔλαιον περιεχούσας; Oribasius, *Ecl. Med.* 115.2: πρὸς δὲ τὰς τῶν κνησμῶν ἐπείξεις πυριατέον ὠμολίνοις ἢ φακωτοῖς πυριατηρίοις ἐξ ὕδατος ζεστοῦ; Cassius Felix 66.7: *aut lentculam testeam vel aeream... appones*; Caelius Aurelianus, *Acut. Diseases* 3.3.12: *apponendae... vesicae oleo dulci calido semiplenae*; Aëtius 9.28.57–59 [Archigenes]: καὶ πυρίας δὲ προσήκει γίνεσθαι... διὰ τῶν φακωτῶν πυριατηρίων καὶ διὰ κύστεων βοείων ἡμιπλήρων ὕδρελαιοῦ.

969 For a foot warmer at Rimini see Jackson (2003) 320 Fig. 6. There are two warmers shaped as hands in the Paphos Museum. These come from Nea Paphos (2nd to 4th century CE). For Paphos and other locales see Nikolaou (1989).

Appendix

Materials, Sutures, Plugs, ‘Tents,’ etc.

Ankter (ἀγκτήρ)

Was an *ankter* a type of suture or a metal clasp? Celsus seems to promote the idea of the latter when he unites a gaping flesh wound, not with sutures (*sutura*), but with *fibulae* which he says the Greeks call *ankteres* (5.26.23B).¹ Ordinarily, one understands *fibula* as designating a metal clasp, pin or buckle; so received opinion has inclined to see Celsus’ *fibula* as something of that nature arranged in such a way as to close a lesion, perhaps fixed in place by a thread.²

Greek sources, often overlooked, would seem to resolve the issue decisively against *fibula/ankter* in this sense. Like Celsus, authorities such as Galen and Paul frequently cite sutures (*rhapchai/rhammata*) and *ankteres* in conjunction.³ Perhaps the similarity of language in all three authors has had the effect of transferring to Greek terminology assumptions already reached by many about the nature of Celsus’ *fibula*, i.e., that the *ankter* was a metal pin. However, three texts in Oribaisus’ *Collectiones Medicae* show clearly that an *ankter* was no such thing.

Book 44, chapter 7 deals with drainage of an intercostal abscess or empyema. Early in the operation this directive is given:

Let the skin first be cut, and before the abscess is opened pass four *ankteres* of suture thread through the lips of the incision, two and two.⁴

1 ... *sutura quidem aliena est: inponendae vero fibulae sunt (ancteras Graeci nominant)* ...

2 See: Johnston-Horsley, Galen, *Method of Medicine* (2011) Loeb I, 391 “a type of pin”; Boudon, in Galien, *Art Médical*, in *Galien* vol. II, Bude series, (2000) 366 “agrafes”; Drabkin, Caelius Aurelianus, *On Acute Diseases, On Chronic Diseases* (1950) 661 “surgical pins”; and Spencer, Celsus, *De Medicina* (1938) Loeb II, List of Surgical Instrument, etc., p. LXI: “Fibula, Greek ἀγκτήρ, originally a brooch, safety pin, was used by Celsus of pins passed through the margins of wounds and fixed by a thread twisted round them in a figure of 8...” Milne (1907) 163 was undecided but leaned to clasp. Helmbold, Plutarch, *Moralia* 468C (1939) translated *fibula* as “clips for wounds”, citing Milne. At 7.25.2 Celsus describes a fibula used to to promote the voice and health of adolescent boys. This certainly is a pin/clasp, as is the *fibula aenea* mentioned by Columella for puncturing and scratching lines in animal tissue (*On Agriculture* 6.5.4 & 6.17.4).

3 Galen, *Meth. Healing* 10.230K = J-H 1.348–349; Paul 6.107.1 (ἀγκτήρσι καὶ ῥαφαῖς χρῆσάμενοι).

4 τεμνέσθω δὲ πρῶτον μὲν τὸ δέρμα, καὶ πρὸ τῆς τοῦ ἀποστήματος στομώσεως διὰ τῶν τῆς διαιρέσεως χειλῶν ἀγκτήρες ῥαμμάτινοι διεκβαλλέσθωσαν τέσσαρες, δύο καὶ δύο ... Aëtius 7.85.15 = Hirschberg, Waugh pp. 122–123. Chp. 85 (growths on eyelids) may also be cited: “next treat/cure

The purpose of the *ankteres* in this case is to hold in place dressings. Clearly thread, not pins are at issue here. The *ankteres* are later cut through and removed.⁵

In book 48, chapter 28, the topic shifts to bandages. One type, called ‘Split Bandage for Eyes’ requires three bands of cloth wrapped about the head. All are called *telamon*, a term also used by Greeks for tourniquet (see above under Miscellaneous and Parasurgical Items). To construct the bandage the bands are maneuvered and knotted. In the course of the process the ends of the narrowest of the bands, which had initially been positioned at the crown of the head, are interchanged (perhaps crossed) under the chin to anchor another band. This narrowest band is referred to as an *ankter*:

After [another *band*] has been knotted, the ends of the oblique [narrowest] band (this is called *ankter*) are interchanged, so that by the interchange of its ends, the [other] band is, as it were, secured by being tied in place.⁶

At the end of the process “the ends of the *ankter* are bound to one another at the crown of the head.”⁷

Again, in chapter 35 of the same book we encounter a bandage called ‘Lip Guard of Heliodorus.’ As in chapter 28, the procedure begins with a band (*telamon*), this time unspecified as to size, called *ankter*, which is again positioned initially at the crown of the head (ἀγκτήρα δεῖ τάξαι κατὰ τὸν τῆς κορυφῆς τόπον . . .) and coordinated with another (narrow in this case) *telamon*. In similar language, the ends of the *ankter* are knotted and tied together at the end of the process.

The last passage of interest is the account of *gastrorrhaphia* (stiching up the abdomen on horses) in *Hippiatrica Berolinensia* (71.1.3–8 [Apsyrtus]). The procedure, we are told, is the same as for humans: stitch with a woven thread of wool, not too fine. Pick out the ends; then bind the fat and hide with an *ankter* consisting of a cord of waxed hemp . . . on the seventh day remove the *gastrorrhaphia* and take out the stitching.⁸

By chance the process of *gastrorrhaphia* is also raised by Scribonius Largus in his chapter on “The Green Plaster of the Surgeon Glycon” (*Comp.* 206). This plaster, he

(these conditions) by stitching the edges of the skin with an *ankter* (ῥαφή ἀγκτηριασθέντα τὰ χεῖλη τοῦ δέρματος . . .).”

5 οἱ ἀγκτήρες διακοπτόμενοι κοιμίζεσθωσαν.

6 μετὰ δὲ τὸν ἀμματισμὸν ἐναλλάσσονται αἱ ἀρχαὶ τοῦ πλαγίου τελαμώνος (λέγεται δ’ οὗτος ἀγκτήρ) ἵνα τῇ τῶν ἀρχῶν ἐναλλαγῇ ὡς ὑπὸ τοπικοῦ ἄμματος κρατηθῇ ὁ τελαμών.

7 ἐπὶ τέλει δὲ τοῦ ἀγκτήρος αἱ ἀρχαὶ κατὰ τὴν κορυφὴν πρὸς ἀλλήλας διαδέονται.

8 δεῖ . . . ῥάμματι ἐρεῶ κεκλωσμένῳ μὴ λεπτῷ, καὶ ἐκλαμβάνειν τὰς ἀρχὰς ἔξω, ἀγκτηριάζειν τὴν πιμελὴν καὶ τὴν βύρσαν σφηκώματι κανναβίνῳ κεκηρωμένῳ . . . ἐβδομαίου δὲ γενομένου, λύειν τὴν γαστρορραφίαν καὶ ἐξαιρεῖν τὸ ῥάμμα.

relates, is said to help join divided parts already brought together with *fibulis* as in “what the Greeks call gastrorrhaphia.”⁹ But as *Hippiatrica Berolinensia* shows, *ankter* in this context has nothing to do with pins but is a stitch, or some kind of surgical knot of thread; therefore *fibula* must mean the same in Scribonius.¹⁰

Returning to Celsus it is appropriate to acknowledge that, in addition to 5.26.23B, he uses surgical *fibulae* to close wounds or to hold tissue in position at 7.4.1B (fistula), 7.6.4 (steatoma), 7.19.5 and 7.22.3–4 (scrotal hernia). The standard translation in English (Spencer) regularly renders *fibula* as ‘pin’ in all of them. But against the background of the testimonia so far produced, we are encouraged not to think of the *fibula* as a pin, its standard meaning in non-surgical contexts, but as a surgical stitch or knot. I offer my own translation of 7.22.3–4 and invite the reader to envisage *fibula* as a creation of needle and thread there and, analogously, in the other passages cited in Celsus as well. The subject is a varix when an entire testicle is involved

Then *fibulae* have to be applied to the margins (of the incision) so that they comprehend the veins as well. You do it this way: the needle (*acus*) perforates one margin of the wound from the exterior. Next it is passed, not through the vein itself, but through its membrane, and then is forced into the other margin. The vein should not be injured so as to bleed. The membrane is always between these veins and there is no danger. Bound by a/the thread it [the membrane] holds the veins in place quite well. So just two *fibulae* will do . . . The *fibulae* should be removed when there is no inflammation and the wound is clean, so that the scar binds together the margins of the incision and the veins.¹¹

An *ankter*, therefore, was a piece of thread or cord for stitching/knotting or a band of cloth tied up at its ends as part of a bandage. In this respect it has nothing in common

9 . . . iungit omnem partem divisam et fibulis coartatam, praecipue cum intestina prolapsa et reposita sunt, atque sartum vulnus quod a Graecis gastrorrhaphia dicitur.

10 Also to note is Van Almeloveen's proposed reading *ligamentorum et fibularum* in the context of closing wounds at Caelius Aurelianus, *Chron. Diseases* 2.12.146. Even if *fibularum* is what Caelius did write, that again would not affect the views expressed here as to the nature of the surgical *fibula*.

11 *Tum fibulae oris sic iniciendae, ut simul eas quoque uenas comprehenda<n>t. Id hoc modo fit: acus ab exteriore parte ora<m> uulneris perforat; tum non per ipsam uenam sed per membranam eius emittitur per eamque in alteram oram conpellitur. Vena uulnerari non debet, ne sanguinem fundat. Membrana semper inter has uenas est, ac neque periculum adfert, et filo comprehensa illas abunde tenet. Itaque etiam satis est duas fibulas esse . . . Soluendi fibulas tempus inflammatione finita et purgato uulnere est, ut una simul et oras et uenas cicatrix deuinciat.*

with metal or wood used as a bolt, peg, bar or pin.¹² But in terms of its appearance as a stitch, it may have resembled a metal pin and for this reason been rendered as *fibula* by Latin authorities. Whatever form the stitch called *ankter/fibula* took, it seems, like the band called *ankter*, to have been an independent arrangement meant to provide temporary support, perhaps a kind of cross stitch, as opposed to continuous suturing.¹³

Balanos (βάλανος, dim. βάλανιον, βάλανις)

Latin writers transliterate the Greek name (*balanus*) and also equate with it the term *collyrium*.¹⁴

Balanos (“acorn,” “door bolt,” “glans penis”), in the sense of ‘pledget’ or ‘suppository’, occurs frequently in the literary sources. The Hippocratic *Gynecolgy* is particularly replete with recipes for *balanoi*, as with this mild cathartic in *Diseases of Women* (8.84.6–8L):

Grind up all these ingredients and make a *balanos*, winding it in a fine rag around a feather. Then bind it up, dip it in white Egyptian oil and apply.¹⁵

In some cases *balanoi* consist solely of their bound ingredients; in others they are made up of ingredients bound together or soaked in a rag or tuft of wool, as in the passage

12 Hence the later glossary known as the *Hermaneumata Monacensia* (207.48) correctly equates fibula with a stitch or stitching: *fibula rafe*.

13 So also Proff (1992) 182–184 who viewed *fibula* as a single stitch (‘Einzel- oder Knopfnah’). He reached this conclusion by considering Celsus 5.26.23B in the light of modern surgical procedure; but he did not exploit Oribasius and the *Hippiatrica*, which both conclusively eliminate pin but do not clearly settle the type of stitch a *fibula/ankter* was. Before Proff, S. Reinach, who also missed the Greek sources, saw the surgical fibula vaguely as ‘a device’ (*un dispositif*). But like Proff and like myself Reinach distinguished it from a suture in being independent and not continuous (Daremberg Saglio *Dict. des antiquites grecques et romaines, etc.*, II/2 1111 s.v. (xxiii). I learn recently that Mathias Witt (2009) n. 341(7) p. 221 has seen, before me, the value of Oribasius, *Coll. Med.* 44.7 and *Hippiatrica Ber.* 71.7 in arguing that *fibula/ankter* is a stitch. His treatment of gastrorrhaphia is exhaustive.

14 So Caelius Aurelianus, *Acute Diseases* 3.16.135: *alii collyria ex ipso (hellebore) facientes, quae appellaverunt balanos*... See also *ibid.* 3.17.153. Most of the terms for pledget, suppository, etc., in Greek are equated as well; see below under *Hupotheton* and *Prostheton*.

15 ... πάντα τρίψον καὶ ποιήσον βάλανον, περὶ πτερῶ ῥάκος λεπτόν περιθείς, καταδῆσαι καὶ ἐμβάψαι ἐς ἄλειφα λευκὸν αἰγύπτιον καὶ προστιθέναι...; see also [Hippocrates] *Diseases of Women* 8.205.34–35L... ἐν ῥάκει ἢ ἐν εἰρίῳ βάλανον ποιέειν.

above.¹⁶ Aëtius in one case attaches a string for retrieval.¹⁷ In the Hippocratic treatise *Fistulas* 3P a piece of horn smeared with fuller's earth is inserted into the rectum as a *balanos* (βάλανον . . . κερατίνην) after a medicated plug (στροβίλην) has been positioned within the fistula. This early device is reminiscent of the tubes of metal that were similarly employed in Imperial sources (see under Tubes: Tubes to Prevent Contractions and Adhesions).

Not surprisingly *balanoi* vary in thickness and length¹⁸ for effective insertion into an orifice of the body: the female organs, the rectum, even the ear. For temporary hearing loss, Aëtius provides this prescription:

Taking (sc. watercress seed, etc.), make little *balanoi* that fit the acoustic passage. Insert them and leave them for three days. This removes enough wax and instantly provides relief.¹⁹

Oribasius, *Coll. Med.* 8.39 offers an extensive excerpt from Rufus conveniently summarizing situations in which *balanoi* were believed effective.

And in fact we often use them for evacuation of faeces, especially in cases where patients cannot abide a clyster and where children and women are concerned. Sometimes we also use them for nausea or headcolds, or when the parts are easily provoked by clysters, or when a clyster injection to stimulate or to provoke evacuation is not expelled. We also use them often as cathartics and to affect change in cases of fevers, both acute and chronic, and severe sore throat and other conditions that provoke choking . . . (1)²⁰

16 Pliny mentions simply using an onion as a *balanus* against hemorrhoids (*Nat. Hist.* 20.43). Severus compares a *balanos* of copper sulphate and honey to a pill (οἶον παστιλώδες: *De instrumentis infusoriis seu clysteribus*, etc. p. 40).

17 16.72.38–9: ἐξ ἄκρου δὲ σπαρτίῳ δεδεμένον ἔσω εἰς τὸ ἐπισπᾶσθαι.

18 Apart from the diminutive form, see also, e.g., [Hippocrates], *Superfetation* 33P βαλάνους ποιῆσαι, ὁκόσαι ἂν δοκέωσι μέτριαι εἶναι μέγεθος καὶ πάχος, οὕτω προστίθει πρὸς τὸ στόμα τῆς μήτρης; Aëtius 9.28.32: μακράς δὲ βαλάνους πεποιῆσθαι δεῖ, ὡς ὑπερβαίνειν τὸν σφιγκτήρα. Caelius Aurelianus (*Acut. Diseases* 3.17.153) recalls the Hippocratic prescription for a *balanos* 10 digits (= 7 inches) long for ileus (*Diseases* 3.14P).

19 6.80.39: . . . ἀναλαβὼν ποίει βαλάνια ἀρμόδια τῷ πόρῳ τῆς ακοῆς· καὶ ἐντίθει καὶ ἕα ἡμέρας τρεῖς· τοῦτο ἄγει ῥύπον ἱκανὸν καὶ παραχρήμα κουφίζει.

20 καὶ γὰρ αὐτοῖς χρώμεθα πολλάκις σκυβάλων χάριν ἐκκρίσεως, καὶ μάλιστα ἐπὶ τῶν μὴ ὑπομενόντων τὸν κλυσμόν καὶ ἐπὶ παιδίων καὶ γυναικῶν, καὶ ἔσθ' ὅτε καὶ ἐπὶ τῶν ἀνατρεπομένων στόμαχον ἢ κεφαλὴν σφηνουμένων, ἢ ἐφ' ὧν τὰ μέρη εὐερέθιστα κλυσμοῖς, <ἢ> ἐφ' ὧν ἐγκατέχεται τὸ ἐνεθὲν ὑπομνήσεως χάριν καὶ ἐρεθισμοῦ τῆς ἐκκρίσεως· πολλάκις δὲ καὶ

Like clysters and *pestoi* (see below) the medications in *balanoi* varied in strength from stronger (δραστικώτεροι) to simpler = milder? (ἀπλούστεροι).²¹

Balanoi introduced to the vagina or womb, as above, were directed to: softening/soothing,²² cleansing,²³ promoting, preventing or terminating pregnancy,²⁴ correcting malposition of the uterus,²⁵ and eliminating hardened growths in the form of millet grains.²⁶ Those inserted rectally were designed to counter fevers,²⁷ rectal paralysis/incontinence,²⁸ hemorrhoids,²⁹ ileus,³⁰ to serve as emetics³¹ and, of course, as purges.³² In this respect, they were regarded as more effective than clysters, at least in some cases. Oribasius says:

We use *balanoi* often for evacuation of faeces and in cases where a clyster does not produce an evacuation. Small *balanoi* (*balania*) are moulded of roasted salt, honey and sodium carbonate.³³

Balanoi were also used to stimulate and evacuate the bladder.³⁴ Because they were basically ephemeral we have no survivals.

καθάρσεως ἔνεκα καὶ μεταγωγῆς ἐπὶ πυρετῶν τινων ὀξέων καὶ χρονίων καὶ συνάγχης καὶ τῶν ἄλλων πνιγμῶν... Similarly Aëtius 3.160.1–9; also Paul 1.45.1.

21 Aëtius 3.23.43; Oribasius, *Coll. Med.* 8.40.5–6.

22 [Hippocrates], *Diseases of Women* 8.205.25, 28, 35L; [Hippocrates], *Superfetation* 33P.

23 [Hippocrates], *Superfetation* 33P.

24 For conception: [Hippocrates], *Diseases of Women* 8.221.19L. For contraception: Aëtius 16.17.5 (βαλάνια μικρά). For abortion: [Hippocrates], *Diseases of Women* 8.78.165–169L (ἐκβόλιον προσθετόν... βαλάνους).

25 Aëtius 16.72.37 (4 fingers long).

26 Aëtius 16.120.6.

27 Oribasius, *Coll. Med.* 8.40.5.

28 Oribasius, *Coll. Med.* 10.13. 4–5.

29 [Dioscorides], *Euporista or Simples* 1.203.1.

30 Oribasius, *Ecl. Med.* 59.3; Aëtius 9.28.26–33 [Archigenes].

31 Dioscorides, *Mat. Med.* 4.148.3.

32 Anonymi Medici = Fuchs 109–110. P43v–44r = Garofalo 96–97.5 (ileus), Fuchs 112P45v = Garofalo 104–105.8 (cholic).

33 *Syn.* 1.20.1: χρώμεθα δὲ βαλάνοις πολλάκις σκυβάλων ἐκκρίσεως ἔνεκεν, καὶ ἐφ' ὧν τὸ ἐνεθὲν διὰ κλυτήρος οὐκ ἐκκρίνεται· πλάσσεται δὲ βαλάνια ἐξ ἁλὸς ὀπτου καὶ μέλιτος καὶ νίτρου. See also Caelius Aurelianus, *Acute Diseases* 2.9.54. Caelius has passim ca. ten references to the application of *balanoi*, all rectal.

34 Oribasius, *Coll. Med.* 8.15.2–3. We find such applications even in veterinary tracts: *Hippiatrica Cantabrig.* 24.1.3, *Hippiatrica Berolin.* 33.8.

Brochos (βρόχος)

The Greek term for a band or cord used for ligation. One frequently encounters it when a tourniquet is needed, as in arresting or preventing a hemorrhage. In his lengthy chapter on extracting missiles Paul advises:

If... there is threat of considerable hemorrhage because of the extraction, on this account we first apply pressure with *brochoi* on both sides [of the wound] and then pull the point.³⁵

Otherwise, we find the *brochos* functioning as tourniquet/ligature when the issue is angeology and arteriotomy,³⁶ strangling hemorrhoids (anal and uterine),³⁷ ligating fistula,³⁸ evacuating an aneurysm or a varix,³⁹ ligating gangrenous tissue in performing gastrorrhaphia and amputating,⁴⁰ correcting umbilical or scrotal hernia,⁴¹ and treating snakebite.⁴²

Brochoi also proved useful in creating extention for aligning breaks and fractures⁴³ and in reducing displacements.⁴⁴ They were even applied when positioning a patient. Paul, for example, before operating for abscess of the womb, places the patient on her back on the midwife's chair with her legs drawn up to her abdomen and her thighs separated. Then (6.73.1):

35 6.88.8: εἰ... καταπαρὲν βέλος πλείονα τὴν αἰμορραγίαν διὰ τὴν ἐξαίρεσιν ἀπειλεῖ, δεῖ ταῦτα βρόχοις πρότερον ἐξ ἀμφοτέρων τῶν μερῶν διασφίγγοντας ἔπειτα τὴν ἐξολκὴν τοῦ βέλους ποιεῖσθαι. See also Celsus 5.26.21C and Galen, *Meth. Healing* 10.317–319K = J-H 3.420–421.

36 Paul 6.5.1; Galen, *Meth. Healing* 10.942K = J-H 3.420–421.

37 Celsus 7.30.3; Paul 6.79.1 (anal); Aëtius 16.109.11 (uterine).

38 Oribasius, *Coll. Med.* 44.21.1 & 17 [Meges] and Paul 6.78.3 (where it is simply called τὸ λίνον 'the band of linen'). The procedure can be traced back to the Hippocratic treatise *Fistulas* 4P and forward to Leon Iatrosophistes (*Consp. Med.* 5.18.2).

39 Aëtius 15.10.34; Paul 6.82.1.

40 Paul 6.52.6; Galen, *Meth. Healing* 10.423K = J-H 2.180–181.

41 Paul 6.51.2 (exomphalos); Celsus 7.19.3 and 8 (scrotal hernia); Aëtius 16.114.7 (cirsocele in females), Paul 6.64.2 (cirsocele in males).

42 Philumenus, *Venomous Creatures* 7.8.5–9.1; copied by Pseudo-Dioscorides, *Venomous Creatures* [Theriaca], 19.45–47.

43 Galen, *Meth. Healing* 10.430K = J-H 2.190–191 (general); Paul 6.99.2 (arm [Soranus]); 6.102.1 (thigh).

44 Paul 6.118.3 (hip).

Let her arms be brought down under her hams and fastened to her neck with properly corresponding ligatures.⁴⁵

There is abundant testimony to the materials used. Linen is frequently mentioned, sinew and wool rarely.⁴⁶ Galen will settle for silks (νήματα σηρικὰ) and dry gut (ισχνή χορδή) for ligatures that do not quickly rot but recommends “so-called Gaitanian linen, brought down from the land of the Celts”; this he claims is cheap and readily available along the Sacred Way leading from the Temple of Roma to the markets (Galen, *Meth. Healing* 10.942K = J-H 3.420–421).⁴⁷ The *brochos* is sometimes said to be two-ply or five-ply or woven/plaited.⁴⁸ In all cases the need is for material that bears up under pressure.

Celsus regularly refers simply to ligation with a *linum* (= band/cord of linen) when he treats of any conditions mentioned above. Thus he ties off blood vessels while operating for scrotal hernia *longiore lino* at 7.19.3 & 8 (see also 7.22.2 & 5 and 7.24) and strangles hemorrhoids *lino* at 7.30.3.⁴⁹ We find the same term (λίνον πεντάπλοκον ὠμόν) substituted for *brochos* in Paul’s treatment of anal fistula, where he follows the Hippocratic method of apolinos (6.78.3).

One finds numerous references to application of a *brochos* to, e.g., blood vessels and nerves in Galen’s experiments with animals.⁵⁰

Canalis/σωλήν (solen)

Gutter splint for fracture of the lower extremities. In the Hippocratic treatise *Fractures* there is both approval and disapproval of its use, depending on the situation (3.16 and

45 ὑποβεβλήθωσαν δὲ αὐτῆς οἱ πῆχεις ὑπὸ τὰς ἰγνύας καὶ βρόχοις τοῖς καταλλήλοις ἀνειλήφθωσαν πρὸς τὸν αὐχένα.

46 For linen, see Oribasius, *Coll. Med.* 44.21.16–17; Aëtius 15.10.34; and Paul 6.5.1 (ὠμολίνον = coarse linen), 6.64.2, 6.82.1. For sinew, see Oribasius, *Coll. Med.* 45.24.8. For thread/yarn or wool, see Galen, *Anat. Proc.* 2.670K = 11.505Gar (χρόκαις ισχυραῖς ἢ νήμασιν ἐξ ἐρίων).

47 See Lund (1936) 119 whose rendering of Galen I quote. For flax grown in Roman Gaul under the Empire, see Wild (1970), esp. 13–15.

48 Paul 6.5.1, 6.64.2 (two ply), 6.79.1 (5 ply), 6.118.3 (woven or plaited and equated with leather straps: βρόχοις ὕφαντοῖς ἢ πλεκτοῖς ἡγοῦν ἱμάσιν ἐκδήσαι τὸ σκέλος).

49 Caelius Aurelianus (*Chron. Diseases* 2.12.152, 187, 191) arrests hemorrhage *ligatura* and *ligatio* but these terms designate the process of ligating, not the band itself. *Ligamentum* has been conjectured for the actual band at (146) where the text is uncertain.

50 See *Anat. Proc.* 643–648K = 11.473–479Gar (arteries), 668–670, 690K = 11.503–507, 529–531Gar (nerves). See also Theophilus Protospatharius, *Fabric of Human Body* 3.16.

22L; cf. Oribasius, *Coll. Med.* 46.1.73). Galen contrasts it with the *glossokomon* or box splint⁵¹ as follows:

The *solen* is like the *glossokomos* in other respects but differs from it in form. It is cylindrical on the outside and hollow inside, like the gutters/channels on roofs, from which it gets its name.⁵²

Celsus (8.10.4A) wants his *canalis* fitted with openings at the lower end for fluid evacuation and with a stay (*mora*) at the sole of the foot for support and prevention of slippage.⁵³ Paul says ‘The Moderns’ reject the *solen* in favor of blankets, rags and skins, but he notes that some used to employ wood and clay models in which the limb was laid (6.106).⁵⁴

Oribasius (*Coll. Med.* 45.15.10 [Antyllus]) speaks of a leaden (μολιβοῦς) *solen* bound together with with a splint (*narthex*) to keep, e.g., a finger straight in the wake of surgery for stiffening/contraction (*ankulion*).

Elasmata (ἐλάσματα)

See below, Metal Plates.

Erion: (ἔριον)

See below, s.v. wool.

Fascia

Standard Latin term for bandage but also a truss for hernia. For the latter, see below, s.v.

51 The *glossokomon* was a complex mechanism featuring ligatures and pulleys enclosed in a boxlike frame. Galen (*Meth. of Healing* 10.442–443K = J.-H. 2.209–213) and Oribasius (*Coll. Med.* 49.21) give descriptions of two versions. J.-H. illustrate (fig. 5) the one described by Galen as well as the gutter splint.

52 *Comm. Hipp. Fractures* 18b.504K: ὁ γε μὴν σώλην τὰ μὲν ἅλλα ἔχει τὰ αὐτὰ τῷ γλωσσοκόμῳ, ἀλλ’ αὐτῷ δὲ τῷ σχήματι διαφέρει. περιφερὴς γὰρ ὢν ἔξωθεν ἔνδοθεν ἐστι κοῖλος, ὁμοίως τοῖς ἐπὶ κεράμων σωλήσιν, ὅθεν αὐτῷ τοῦνομα.

53 *et inferiore parte foramina II habere debet, per quae, si quis umor excesserit, descendat; et a planta moram, quae simul et sustineat eam et delabi non patiat.*

54 τινὲς μὲν οὖν ἐπὶ σωλήνος, οἱ μὲν ξυλίνου οἱ δὲ ὀσταρκίνου τὸ κατεαγὸς ἀπετίθεντο κῶλον . . . Galen mentions splints of limewood (ἐκ φιλυροῦ); *Comm. Hipp. Fractures* 18b.505K.

Ferula/νάρθηξ (*narthex*)

The name of the giant fennel, extended to designate a splint as well. References to *narthex* splints for fractured legs and arms occur in several Hippocratic treatises, in particular *Fractures* (e.g. 3.6, 9, 16, 19L), Galen's commentary on *Fractures* (18b.318–628K), and Oribasius, *Coll. Med.* 46.1 (much of it a rehash of Galen's commentary).⁵⁵ Celsus (8.10.1K, 2D, 3B) also refers to *ferula* splints for fractured limbs; for their application to fractured jaw we may cite Paul 6.92.2. In some cases *narthex* splints are applied without fracture: e.g., to dislocations ([Hippocrates] *Joints* 4.27.8–10L) and to fingers afflicted with fistula, where a piece of limewood will also do (Oribasius, *Coll. Med.* 44.20.74 [Antyllus]).⁵⁶

Caelius Aurelianus describes (with disapproval) whipping and thereby reddening the abdomen with supple (*tenerae*) *ferulae* or *tabellae* in treatment of paralysis of the bladder (*Chron. Diseases* 5.4.78). Similar striking, whipping, etc., with fennel stalks to create swelling, as a rubifacient, etc. can be found in Galen, *Meth. Healing* 10.998K = J.-H. 3.502–503 (increasing body mass by ἐπίκρουσις or pummeling) and Oribasius, *Ecl. Med.* 73.23 (treatment of paralysis by φοινιγμοί or rubifacients).⁵⁷ The veterinary *Hippiatrica* pummel a dislocated equine shoulder with fennel stalks, a horseshoe bound with a rag, or a rod padded with wool prior to cutting/trepanning (*Ber.* 26.7.3; 26.9.3–4 & 26.18.5).⁵⁸

Fibula

See *ankter* above.

Hemitubion (ἡμιτύβιον)⁵⁹

Defined by Galen in his *Hippocratic Glossary* as a piece of thick linen cloth (19.102K: ὀθονίου παχέος μέρος). In the *Hippocratic Corpus* its lint is used to form a plug for setting

55 Qualifications are few; cf. [Hippocrates] *Fractures* 3.6 & 48L where thick(er) and shorter types are recommended (παχύτατον—τὸν νάρθηκα, τινὰς τῶν νάρθ. βραχυτέρους; παχέες οἱ νάρθηκες) and Galen's *Comm. Hipp. Fractures* 18b.395–399K, echoed by Oribasius, *Coll. Med.* 46.1.92.

56 ... νάρθηκιον ἢ φιλύριον στανίδιον συνεπιδεῖσθαι στηριγμοῦ χάριν.

57 These procedures reappear in Paul 3.18.4; 3.69.1; 6.51.1.

58 There may have been such a procedure somewhere in a lost portion of the *Hippocratic Corpus*. Galen, *Hippocratic Glossary* 19.131K records the occurrence of πλῆστιγγας· νάρθηκας, παρὰ τὸ πλῆσσειν.

59 An Egyptian term according to Pollux 7.71.

a fractured nose (*Joints* 4.37.10–11L), and rough rags of it are applied to the back and chest of patients suffering from bronchial conditions (*Diseases* 2.54P). Aretaeus too uses a rough *hemitubion* as a rubefacient to stimulate the legs, back and ribs in cases of dizzy spells and their complications (*Care Chronic Diseases* 1.3.8).

Hupotheton (ὑπόθετον)

As *prostheton* below, a general term for a molded medication. *Hupotheta* are applied anally for rectal and intestinal problems.⁶⁰ In some texts *hupotheton* is synonymous with *balanos*, *kollurion* and *kokkion* (pill). For examples see: Aëtius 5.68.35 (βάλανος), 9.41.54 (κολλύρια); Oribasius, *Ecl. Med.* 61.5 (κοκκία); and Cassius Felix: *collyrium suppositorium, quod Graeci ypotheton vocant* (48.19, dysentery).

Ipoterion (ιπωτήριον)

The term derives from the verb *ιπώω* (press, squeeze), and refers to a particular suppository made of papyrus.⁶¹ Oribasius' account of fistula, extracted from the writings of Antyllus, Heliodorus, and Meges, attests its insertion in fistulas to open and enlarge (*Coll. Med.*, 44.20.61 & 44.21.9). Another extract from Heliodorus describes its preparation using a tube (*solenarion*) of copper alloy or tin or even a feather. Its function in this case is to keep the urethra open in the wake of surgery for occlusion.

The papyrus is moistened for two or three days. When it becomes swollen, the *solenarion* is placed on it and then [the papyrus] is wrapped tightly around. If the quill of a feather is placed on it, let the shaft of a probe (*melotris*) be inserted in the quill before the wraparound . . . The *ipoterion* is allowed to dry until it is quite shrunken. Then it is molded for use in proportion to the size of the urethra . . .⁶²

60 See, e.g., Pseudo-Galen, *Drugs Easily Procured* 14.468K; Alexander of Tralles, *Therap.* 2.425.21 & 27; Aëtius 9.P.39, 9.32.title, 9.41.54; Paul 7.12.42. For *balanos* as *hupotheton* see Aëtius 5.68.35; for *krokus* as *hupotheton* see Aëtius 9.41.28–32.

61 It also was applied to a plaster (*pharmakon*) for people with delicate skin. Galen attributes its creation to Heracleides of Tarentum (*Cmpds. by Kind* 13.725).

62 βρέχεται ἡ πάπυρος ἐπὶ δύο ἢ τρεῖς ἡμέρας· ὅταν δ' ἐμφυσηθῇ, ἐντιθεται εἰς αὐτὴν τὸ σωληνάριον καὶ τότε περισφίγγεται. ἐὰν δὲ πετροῦ καλαμὶς ἢ ἡ ἐντιθεμένη, πρὸ τῆς περισφίγγεως εἰς αὐτὴν ἐντιθέσθω μῆλωτρίς· ἔλασμα, καὶ τότε σφιγγέσθω, . . . ἔσται δὲ ξηρανθῆναι τὸ ἰπωτήριον ἕως οὗ μάλιστα σκελατευθῇ καὶ πρὸς τὴν χρεῖαν τότε ἡ πάπυρος περιγλύφεται ἀναλόγως τῇ οὐρήθρᾳ . . . : *Coll. Med.* 50.9.8–11.

The *ipoterion* recorded in the veterinary *Hippiatrica* (*Cantabrig.* 29.5) to relieve dropsy and spleen disease is clearly a plaster.

Kephalike (emplastros) of Philotas and Others

A plaster classed among those called *rhaptousai* (literally ‘stitching’) because they were useful for closing/sealing (Celsus 5.19.6). Galen gives a recipe for this compound, which he attributes to Philotas of Amphissa. Its primary ingredient was *ichthuokolla*, or gelatin derived from the swimming bladders of freshwater fish. Philotas’ *kephalike* is of particular interest because Galen says it knit broken/corrupted bone and dissolved calluses (*Cmpds. by Kind* 13.745K: ἀνάγει ὅστ᾽ διεφθορότα καὶ τύλους ὑπεκτῆκει). Its name points especially to skull work. For full details, see Scarborough (2012a) 12–13 and (2014b).

Krokus, pl. krokudes (κροκύς)

Technically the nap or downy surface of woolen cloth or a piece of the cloth itself. In surgical texts the nap is frequently molded into a medicated rectal suppository for treating hemorrhoids and promoting evacuation, as in Galen, *Simples* 12.50:

Cyclamen acts in various ways. It cleanses, divides/dilutes, opens, draws, and disperses. This is apparent from the effects of its parts. It’s juice, for example, opens hemorrhoids and strongly provokes bowel movement when applied in a *krokus*.⁶³

Similarly, we find a *krokus* annointed with drugs and introduced rectally: to relieve anal fissures and calluses (Aëtius 3.161.1–5), with opium as a soporific and narcotic (Galen, *Cmpds. by Place* 13.273 = Aëtius 9.32.5), with mandrake and opium for phrenitis (Themison?, see Fuchs [1903] 72), with the purge hellebore when patients are reluctant to take it orally (Paul 7.10. 5 [Antyllus]), with oils, etc. to treat colic (Alexander of Tralles, *Therap.* 2.343.22; see also Oribasius, *Eunap.* 4.86.7), with a mixture of rue and other ingredients to relieve flatulence (Oribasius, *Syn.* 3.209.3; Paul 7.9.1), with radish oil and gum ladanum to relieve constipation (Aëtius 9.41.31), and with balsam oil to stop dysentery (Oribasius, *Ecl. Med.* 54. 20).

63 κυκλάμινος ποικίλος τὴν δυνάμιν ἔστι· καὶ γὰρ καὶ ῥυπτει καὶ τέμνει καὶ ἀναστομοῖ καὶ ἐπισπᾶται καὶ διαφορεῖ. δῆλον δ’ ἐκ τῶν κατὰ μέρος ἔργων. ὁ μὲν γὰρ χυλὸς αὐτῆς αἰμορροΐδας ἀναστομοῖ καὶ προκαλεῖται βιαίως εἰς ἀπόπατον ἐν κροκύδι προστιθεμενος (copied by Oribasius, *Eunap.* 2.1.kappa.104). See also Dioscorides, *Mat. Med.* 2.78.2 (ox bile as laxative).

In his treatment of rectal fissures and calluses, Aëtius (3.161.1–5) states that the harshness of a *balanos* dries up these conditions such that a *krokus* was preferred.⁶⁴ I am uncertain why this should have been universally true of a *balanos*: perhaps the distinction only applies in this particular case.

In addition to the rectum, a vaginal *krokus* soaked with rue juice so as to encourage menstruation is recorded by Oribasius (*Ecl. Med.* 142.8);⁶⁵ another, inserted in the auditory canal to improve hearing loss, is mentioned by the same author (*Coll. Med.* 10.13.5).

Medicated or water soaked *krokus* plugs were used as hemostats after phlebotomy (Oribasius, *Syn.* 8.52.4, copied by Paul 3.22.33) and as a small pledget in a series applied to protect the meninx after trepanation (μικρὸν ἐρίου κροκύδα, Paul 6.90.8).

In a number of instances a *krokus* tuft functions as the modern cotton swab. Situations in which we find such swabs include: application of medicament for uterine ulceration (Oribasius, *Syn.* 9.50.2, copied by Paul 3.66.2) and wiping thrush from the mouths of infants (Aëtius 8.42.44 [Galen]). Such a swab might be wound around a probe, as in a sternutatory prescribed by Aëtius:

...positioning the *krokus* around a probe (*mele*) and dipping it in the drug, anoint the nostrils continuously and whatever is irritating the head will be completely discharged.⁶⁶

Another facial application features *krokus* tufts suffused with purple dye and placed near the outer canthuses in an exercise designed to correct strabismus (Oribasius, *Syn.* 8.51.2, copied by Paul 3.22.32).

In a few instances the nap is wound into a thread, then attached to a *peessos* (see below) or *balanos* to withdraw these suppositories from the orifices into which they had been inserted. For example, Antyllus, in his disquisition on *pessoi*, directs the practitioner to make one for uterine application a bit stickier and thicker: “dip a doubled over tuft of wool, like a narrow *motos* (see below) into the drug and insert it into the cervix with a lengthy *krokus* thread attached to retract the *peessos* easily.”⁶⁷ In another uterine application Oribasius attaches a *krokus* to a collyrium stick intended

64 ἀναξηραίνεται δὲ ταῦτα ὑπὸ τῆς τῶν βαλάνων σκληρότητος, ὅθεν ἀναγκαζόμεθα κροκύσιν ἀντὶ τούτων κεχρῆσθαι...

65 Rue = *Ruta graveolens* L. It was employed as a contraceptive and abortifacient; see Riddle (1992) index reffs., ‘rue.’

66 κροκύδα περιτιθεῖς μῆλη καὶ βάπτων τῷ φαρμάκῳ διάχριε τοὺς μυκτῆρας συνεχῶς καὶ ἀπορρυῖσεται πᾶν τὸ ἐνοχλοῦν τῇ κεφαλῇ (6.52.17).

67 καίπειτα ἔριον μοτῶ στενῷ παραπλήσιον διπλοῦν ἀποβαπτειν εἰς τὸ φαρμακον καὶ προστιθέναι εἰς τὸ στόμιον τῆς ὑστέρας, ἔχον ἐξημμένην κροκύδα ἐπιμήκη πρὸς τὸ ἐπισπᾶσθαι τὸν πεσσὸν εὐκόλως... (Oribasius, *Coll. Med.* 10.25.4, copied by Paul 7.24.2).

as an emmenagogue or as an abortive (*Coll. Med.* 10.23.3), while Paul links one to a rectal *balanos* soaked with hellebore, stressing that it be sturdy (κροκὺδι στερεῶν, 7.10.5). Sometimes a strong thread (ἰσχυρὸν νήμα) was attached to the *krokus* itself to insure its withdrawal, as in Oribasius' directives for dealing with disease of the colon (*Eunap.* 4.86.7). Alternatively, Soranus uses a *krokus* thread to ligate a newborn's umbilical cord or to bind up an infant's deficient foreskin (*Gyn.* 2.11. 3 Ilberg = 2.6.19 BGM & 2.34.4 Ilberg = 2.12.116 BGM).

Finally, the loose nap might also be combined with other ingredients in the creation of various medications: Galen, *Cmpds. by Place* 12.733K (for scabby eyelids, ψωριῶντα βλέφαρα, so too Aëtius 7.79.57 = Hirschberg, Waugh pp. 116–117. Chp. 79), *Cmpds. by Place* 12.821K (for aegilops).

Lana

See below, s.v. Wool.

Lemniskos (λημνίσκος)

Celsus 7.28.2 offers as a definition “a piece of linen folded lengthwise (Greeks call it *lemniscus*).”⁶⁸ This he soaks in vinger and inserts in the vagina after incision of an occlusion. *Lemniscos* is perhaps best viewed as a class of *motos* or *pessos*: see below ss.vv. Aëtius (6.1.41–43 [Leonides]) mentions it as being passed or drawn through abscesses.⁶⁹ Cassius Felix includes in a post surgical dressing for abscesses comprised of lint, a folded compress and sponge, extremely dry and thin/fine *lemniskoi* (18.5). The same authority packs a fistula with a medicated linen version (20.5: *illitum scisso linteolo lemniscum*). For veterinary usage, see Vegetius, *De Mulomedicina* 2.14.3; 2.48.7.

Linen (Cloth or Lint)

From the *Hippocratic Corpus* on linen cloth and lint are abundantly documented in a wide variety of Greek and Latin sources. Its earliest reference in a non-medical text occurs in Aristophanes where it is featured as standard for wound therapy.⁷⁰

68 *implicitum in longitudinem linamentum (lemniscum Graeci vocant).*

69 Treating hydrocephaly: οὐ δεῖ δὲ ὡς ἐπὶ ἀποστημάτων μετὰ τὴν χειροουργίαν λημνίσκους διεκβάλλειν ἀλλ' αὐτάς μόνας τὰς διαίρέσεις τοῖς μοτοῖς διαστέλλειν. μετὰ γὰρ τὴν τοῦ ὑγροῦ ἔκκρισιν ῥαδίως ἐπὶ τούτων παρακολλᾶται τὰ σώματα.

70 *Acharnians* 1175.

In the main, linen cloth or lint was used as a towel, a bandage, in dressings, as a ligature, and as a suppository or pledget. In the latter sense it becomes a *motos*, a *pes-sos* or a *lemniscus* (see ss.vv.). As a suppository/pledget it is generally saturated with medication. In the preparation of medication linen cloth may be deployed to filter or extract ingredients; or again it may be used to bind and suspend them, e.g., for roasting and steaming or for steeping in fluid (see below s.v. *othonion*). Sometimes it is burnt to become an ingredient itself. We also find linen used as a dedication to Asclepius and kindred gods associated with healing⁷¹ and, along these lines, in magical formulas of a medical nature.

The literary sources employ several terms for the nape and cloth derived from the flax plant. *Linon* (λίνον, Latin *linum*), of course, is the one that comes into English. As it is familiar, we may treat its numerous testimonia here. Other terms, *omolion*, *othone/othonion*, *linamentum* and *linteolum* will be treated separately in this Appendix. Because they are abundantly documented as well, they necessitate individual treatment.

Linon, in most respects, is found in the same contexts as the other names. Like them we find it used in forming a bandage or sling;⁷² or, medicated, it is applied to wounds, lesions and areas of pain.⁷³ *Linon* plays a role as well in the preparation of medicines and plasters;⁷⁴ and, in the form of crude flax (sometimes burnt), as an ingredient in them.⁷⁵ One function, however, especially insures the constant presence of *linon* in the surgery or kit: its frequently attested use as thread or cord for sewing and ligaturing, and for attachment to plugs of wool and sponge to facilitate withdrawal. The instruments associated with it are the needle and the eyed probe.

Surgeries for eye complaints are a rich source of information for use of linen thread, mostly for ligating, elevating or positioning.⁷⁶ Interventions include ectropion (Aëtius

71 Bliquez, Rodgers (1998b) 241.

72 E.g., Oribasius, *Coll. Med.* 48.69.11.

73 Aëtius 16.15.10–14 (dystocia/difficult labor [Aspasia]).

74 Oribasius, *Coll. Med.* 12.sigma 44 for bird fat filtered through a linen rag (διὰ ῥάκους λίνου).

75 [Hippocrates] *Ulcers* 11P; *Diseases of Women* 8.78.194 & 209.3L (both clysters), and 246.2L (to drink). See Pseudo-Galen, *Drugs Easily Procured* 14.548K for linen cloth, burnt, mixed with vinegar, and blown into nostrils for nosebleed. A veterinarian might first roast it (λίνον ὀπτόν); see *Hippiat. Ex. Lugd.* 178.3 (parotitis). A bizarre treatment for choiras/struma: killing a viper by hanging with a linen noose and then wrapping the noose around the neck afflicted by choiras ([Dioscorides], *Euporista or Simples* 1.145.2).

76 Wool sutures are preferred for suturing the eyelid in treatment for trichiasis (Paul 6.8.1) and occasionally elsewhere. Soranus, for example, employs woolen thread for ligating the severed end of the umbilical cord of a newborn (2.11.3 Ilberg = 2.6.19 BGM). He explains that linen is too harsh for the delicate nature of the cord, which may explain wool's preference in other situations.

7.74.19–22 [Antyllus] = Hirschberg, Waugh pp. 110–111. Chp. 74; Paul 6.12.1); anabrochismos (Paul 6.13.1);⁷⁷ pterygium (Celsus 7.7.4B; Aëtius 7.62.5–13 = Hirschberg, Waugh pp. 96–97. Chp. 62; Paul 6.18.1); encanthis (Aëtius 7.64.3 = Hirschberg, Waugh pp. 98–99. Chp. 64) and staphyloma (Celsus 7.7.11; Aëtius 7.37.3–29 = Hirschberg, Waugh pp. 56–57. Chp. 37, mistranslated as ‘cotton’; Paul 6.19.1).⁷⁸ All require a threaded needle; in the case of ectropion and staphyloma a double thread is ordered.

Needle and linen thread appear again in ligating tissue in repairing umbilical hernia (Paul 6.51.2) and in securing the peritoneum in repairing enterocele (Paul 6.65.3). The same combination of needle and linen thread occurs when a blood vessel has to be ligated in two places before the vessel itself is incised and emptied. We find several instances in the sources: severing temporal veins to treat headache and correcting aneurysm and varicose veins.⁷⁹

When situations arise necessitating that something has to be plugged, strangled, forced or sawn away, we find linen thread or cord used independently or positioned by probes. Paul, for example, treats hemorrhoids by placing the patient on his back in clear light and, if the method of treatment is strangulation, “we place a five ply piece of linen cord around the edges of each pile and strangle it . . .”⁸⁰

Hippocratic methods of treating nasal polyp with threaded linen included tearing the growth out by introducing into the afflicted nostril a ball of sponge wrapped in linen cord and attached to linen thread in four places, or by looping it with a linen noose. In both procedures probes were used to set the ball or noose in position.⁸¹ Subsequent authorities prefer removal of polyp with cutting instruments. So too Paul but, if some of the polyp remains, he follows Hippocratic lines by running a knotted linen cord through the eye of a probe and using the probe to set the cord in position for its operator to use as a saw (6.25.3). One Hippocratic procedure that was repeated again by later authors was the practice of eliminating an anal fistula by drawing through it, by means

77 Here described as extremely fine thread of flax (ἀπλουστάτου κλωνὸς βύσσου).

78 See also Pseudo-Galen, *Intro. or Physician* 14.784K = Petit 19.6 (encanthis, pterygium and staphyloma).

79 Angiology (Aëtius 7.95.11–14; Paul 6.5.1); aneurysm (Paul 6.37.3); varices (Aëtius 14.84, Cornarius; Paul 6.82.1).

80 6.79.1: . . . λίνον πεντάπλοκον {τῷ αἰμορροϊδοκαύστη ἢ τῷ σταφυλοκαύστη} πρὸς τὰ χεῖλη περιθέντες ἐκάστην αἰμορροΐδα διὰ τούτου τοῦ βρόχου ἀποσφίξομεν . . . Milne (1907) 99 accepts the forceps for applying caustic to the uvula and piles as part of the original text. But this instrument seems superfluous here and I follow Adams in expunging the terms designating it. For strangulation of hemorrhoids by a double linen thread/cord, see also Pseudo-Galen, *Intro. or Physician* 14.789K = Petit 19.14.

81 For these operations the reader may also consult the chapter on Hippocratic Surgery and Surgical Tools: Probes (specifically, *rhabdos* and *atraktos*).

of an eyed probe, a linen cord wrapped around a horse hair. The cord was then tied up at its ends and gradually tightened to cut through the canal until the ligature fell out.⁸²

In addition to the Hippocratic polyp procedure, linen cords for extraction were attached: to a suppository of linen wrapped wool inserted vaginally to promote conception ([Hippocrates], *Diseases of Women* 8.75.68–73L); to a *motos* inserted to regulate draining of empyema ([Hippocrates], *Diseases* 2.47P); to pitch for cleaning ears (Oribasius, *Syn.* 5.26.1; Paul 1.30.1); and to a medicated *motos* inserted after surgery for occluded vagina (Aëtius 16.108.29–32).

For plugging the distal end of a catheter with wool and withdrawing it by a linen thread to create a vacuum, see s.v. Wool below.

Finally, in treating fracture of the jaw Hippocratics might substitute linen thread for gold wire in binding together loose teeth (*Joints* 4.32.6–8L). More mundanely, it could facilitate withdrawal when attached to two sides of an impacted finger ring (Aëtius 14.81, Cornarius).

Linamentum

As the term *linteolum* (see below), linamentum may refer to linen cloth or lint. Naturally, one looks to qualifying adjectives to distinguish the two; but clean, soft, and dry, the few modifiers in Celsus, are not useful in this regard.⁸³ Still, it seems generally that *linamentum* is flaxen lint.⁸⁴

Linamentum has two main functions. The first is as a dressing applied directly to wounds or affected areas. When used this way it may be moistened with water, imbued with medication, covered by plaster, or a sponge, but especially by *linteolum* (see s.v. below) in the sense of linen cloth. Following excision of pterygium, for example, Celsus says, “*linamentum* soaked in honey is to be applied, and on top of that linen (*lintoleum*), and then either sponge or raw/greasy wool.”⁸⁵ The other function is to be inserted as a pledget (medicated or not) into an orifice, or to be positioned as

82 [Hippocrates] *Fistulas* 4P; Celsus 7.4.4A–C; Oribasius, *Coll. Med.* 44.21.11–21; Paul 6.78.3 [Hippocrates]; Leon Iatrosophistes, *Consp. Med.* 5.18.2 & 5.19.2.

83 7.26.5H (*puro linamento*); 6.13.2 (*et mollis linamenti paulum*); 5.26.36A (*linamentum . . . siccum imponendum est*). Pliny must refer to cloth at *Nat. Hist.* 16.73, where *linamenta* are dyed.

84 Spencer (1940–1943) once renders *linamentum* as wool (7.28.2). I do not know on what basis.

85 7.7.4D: . . . *ex melle linamentum superdandum est supraque linteolum, et aut spongia aut lana sucida*.

packing. A partial list of situations calling for *linamentum* in Celsus' *De Medicina* includes (from the head down):

Head: as packing for incisions in angeology to promote constriction of humor carrying veins (7.7.15E).

Eyes: to medicate postoperatively for encanthis (7.7.5); as packing to keep edges of the incised area separated and to promote growth of tissue in correcting logophthalmus (7.7.9B).

Nose: as a medicated plug for ulcerated nostrils and nasal polyp: (6.8.1D. & 6.8.2B); folded and wrapped in leather to reshape a broken nose (8.5.1).

Mouth: as a medicated plug twixt gum and tooth for gumboil and gangrene (6.13.2; 6.15.2); as packing to prevent a tooth from breaking in extraction (7.12.1B).

Abdomen, Groin: attached to a thread (*linum*) to drain suppuration in wake of rib fracture (8.9.1H); as post-operative dressing for umbilical (7.14.4) and scrotal hernia (7.19.5).

Vagina: as a suppository for occluded vagina (7.28.2).

Anus: to medicate and as a post-operative dressing for anal fissures (6.18.7B; 7.30.1A); as part of a post-operative dressing for hemorrhoids (7.30.3C).

Generally: for treatment of wounds (5.26.21A; 5.26.36A; 7.9.5); for treatment of burns (5.27.13B); to cover bone exposed in amputation (7.33.2)

Medicated *linamentum* is a common remedy in dealing with fistulas: see 5.28.12N; 7.4.2B (fistula near ribs); 7.4.4D (post surgical for inward or multiple fistulas).

Employment of *linamentum* in several of these situations reminds one of similar applications of Greek suppositories or pledgets.⁸⁶ Indeed *linamentum* must in fact often be what a Greek healer would call a *motos* or *pessos*.

We may also note several miscellaneous uses. Set afire and dropped into a cupping vessel, *linamentum* produces the vacuum essential to cupping (2.11.1). After use as lamp

86 Cf. especially 7.28.2 where *linamentum* inserted for occluded vagina is said to be what the Greeks call *lemniscus*: <et intus implicitum in> *longitudinem lin<a>mentum* (*lemniscum Graeci uocant*) *in aceto tinctum d<e>mittere*. Cf. also: 5.28.12N where some are said to treat fistula with *linamentum* imbued with honey fashioned into a tent (*collyrium*); 6.8.1D (ulcerated nostril) and 6.8.2B (nasal polyp) where one could easily envisage the *linamentum* inserted as a *motos*, etc.

wick foul smelling *linamentum* can be employed as smelling salts in cases of hysteria (4.27.1B).⁸⁷

Linteolum

Designates a piece of linen cloth or flaxen lint. It is not always easy to tell which. Lint is most likely to be at issue when modifiers like *scissum*, *carptum* or *tiltum* occur, cloth when *lindeolum* is used to cover lint or wool, is folded in multiple layers, is squared, or is used as a bandage.⁸⁸ Celsus (2.33.3) classifies *lindeolum*, along with wool and sponge, as a substance that represses and cools.

As one might imagine, *lindeolum* is mainly found in the context of dressing wounds and/or the application or preparation of medications, often combined with lint, wool or sponge. Celsus 7.30.1 provides a representative example. He raises anal fissures with a hot sponge, excises them, and then dresses them with lint (*linamentum*) covered over with a pad of linen (*lindeolum*) imbued with honey; this amalgam is covered in turn with soft wool and bandaged in place.⁸⁹ Another such example occurs at Cassius Felix (29.26) where thin linen (*tenui lindeolo*) bound over a tuft of wool is prescribed for suffusion of blood in the eye (*hyposfagmata*).⁹⁰ Cassius Felix (20.5) shows a similar relationship with *lemniskos* in treatment of fistula.⁹¹

The following random situations will serve to illustrate the range of uses:

With medication for persistent head wound (Celsus 8.4.22).

Filtering, expressing liquid medication: Cassius Felix 34.3 (dry cough); Marcellus Empiricus, *De Med.* 9.17 (earache) & 27.129 (diarrhea).

Folded double and arranged as part of a truss in setting a broken jaw (Celsus 8.7.3).

Wound around a surgeon's fingers to prevent slippage in reducing dislocated jaw (Celsus 8.12.2).

87 Cf. Pliny, *Nat. Hist.* 32.129.

88 For *scissum* see Cassius Felix 20.5 (fistula); for *carptum* see Scribonius Largus, *Comp.* 205 & 237; for *tiltum* Cassius Felix 19.5: *tiltum ex lindeolo tenui appones* . . . For folded layers see Celsus 8.7.3 (*duplex*), 8.8.1C (*triplex*); for broad see Cassius Felix (21.4 *latum*); for squared see Celsus 6.18.8B (*lindeolum aut panniculus quadratus*).

89 *deinde inponere linamentum molle, et supra lindeolum inlitum melle; locumque eum molli lana implere et ita vincere* . . .

90 . . . *tenui lindeolo subiecta lana ligabis*.

91 *tunc illitum scisso lindeolo lemniscum inicies et eum calcabis donec repleas fistulae cavernam*.

Laid beneath a mustard plaster or strong medication to protect underlying surface or tissue: Celsus 4.2.8 (headache); 5.28.3D (therioma when sinew is exposed).

Bound with hemlock root and vinegar around testicles, especially of infants, for castration without cutting (Marcellus, *De Med.* 33.62).

As a plug covered with wool inserted and bandaged in position to maintain reduction of a prolapsed anus or womb (Celsus 6.18.10).

As a plug inserted into a tube (fistula) to regulate drainage of a dropsy (Celsus 7.15.2).

Caelius Aurelianus records an interesting use of *linteolum* in cauterizing. In treating sciatica it is spread over the affected part and topped with a flat piece of linden wood (*tabulam tiliarem*). Bits of soapwort (*struthium herbam*) soaked in olive oil are then placed on the wood and kindled with a fired cautery iron again and again until the wood has become ashes and the skin is blistered (*Chron. Diseases* 5.1.20).

In a curious way of applying leeches in the initial stages of empyema, Cassius Felix (21.4) sinks a broad piece of *linteolum* into a cupping vessel so that the edges of the cloth hang over the edges of the cup. Next he places leeches on the sunken cloth. The cup is then applied directly to the affected part and the cloth withdrawn.

Moving to the realm of medical magic, Marcellus Empiricus wraps prophylactic oddments like dried bits/parts of toads and snakes (*De Med.* 10.42 & 15.67; nosebleed and synanche) or even written incantations/*carmina* (*De Med.* 10.34; bleeding) in *linteola* suspended from the neck or midsection.

Scribonius Largus, Cassius Felix, and Marcellus Empiricus offer, as Celsus does not, qualifying information as to the types of linen cloth included in their arsenals. In these authorities we find *linteolum* that is soft/of high quality (*delicatum-issimum, tenerum, molle*), thick or dense (*densum, spissum*), plain (*simplex*) and thin or fine (*tenue, rarum*).⁹² Sometimes cleanliness is emphasized (*mundum*).⁹³

Metal Plates (ἐλάσματα)

Elasma is familiar as designating a blade, pestle, probe, shaft or olivary enlargement (πυρήν) of a probe. We also find the name used of a plate or strip of metal applied for

92 Scribonius Largus, *Compositiones*: 53 *semen linteolo spisso inligatum*, 227 *post hoc tenue simplex rarum linteolum imponere oportet*; Cassius Felix 30.2 *molli linteolo*; Marcellus Empiricus, *De Med.* 1.24 *linteolo denso*, 8.84 *per linteolum delicatum*, 32.7 *in linteolo tenero*.

93 Cassius Felix (34.3 & 53.2); Marcellus Empiricus, *De Med.* 1.40.

various conditions. Soranus prescribes placement of a flat, thin lead *elasma* under the loins to treat gonorrhea or spermatorrhea (*Gyn.* 3.46.2 = 3.14.19 BGM, copied by Aëtius 16.68.13–15); similarly, Paul places one in the same area to prevent ‘nocturnal effusions’ (ὄνειρωγμοί: 7.3.12.103).⁹⁴ Paul also employs a lead *elasma* to shape superabundant callus in cases of fracture (6.108.1) and maintains that a leaf of that material (πέταλον μολυβδοῦν) disperses a ganglion (7.3.12.104). Such plates also occur in the preparation of medications. For example, fired *elasmata* of iron or steel are plunged into milk to reduce its whey content before consumption to relieve diarrhoea (Aëtius 2.95.16–19 [Galen] and 9.33.25–27 [Philumenus]) and, according to [Dioscorides], a small round golden *elasma* (χρυσὸν ἐλασματίον μικρὸν τι . . . περιφερές) can be taken orally with lead monoxide as an emetic (*Euporista or Simples* 2.168.1).

Motos (μοτὸς, Rarely διάμοτον,⁹⁵ dim. μοτάριον, pl. μότα//μοτά)

Late Latin authors transliterate: *motarium*.⁹⁶

In the *Hippocratic Corpus* *motos* sometimes refers to a metal tube used for drainage; otherwise the name designates tampons, pledgets or ‘tents’, of cloth or lint, sometimes with medication.⁹⁷ This is the only sense in which *motos* occurs in Imperial sources.

In Aëtius’ account of imperforate vagina/womb, for example, we are directed to “pack the incision with *mota* of lint and hold them in place with a bandage . . . then employ *mota* soaked with moist rose salve.”⁹⁸

According to Pseudo-Galen,⁹⁹ there were five types (μοτῶν δὲ εἶδη πέντε): twisted (στρεπτός), shredded or shaved (ξυστός), shredded (τιλτός), of lamp wick lint (ἐλλυχνιωτός), and in the shape of a phallus (πριαπισκωτός).¹⁰⁰ While is clear that all

94 These passages may refer to nocturnal emissions: Note Dioscorides *Mat. Med.* 3.132.2 where νυμφαία (yellow water lily: *nuphar luteum*) is prescribed for ὄνειρωγμοί: ἀτονίαν τε ἐργάζεται αἰδοίου.

95 See, e.g., Paul 6.84.1. The verb διαμοτῶ on the other hand occurs frequently from the Hippocratics through the Empire. Occasionally we find a noun designating the process: διαμότωσις (Aëtius 6.1.43 [Leonides]).

96 Caelius Aurelianus, *Chron. Diseases* 3.8.134 (*motarium aqua infusum*); so also Theodorus Prisc., *Euporiston* (Rose) 1.61.

97 For Hippocratic medicated linen *mota*, see e.g. *Diseases* 2.33 & 34P. The name was probably extended from these to cover the metal tubes, some of which were also smeared or packed with medication.

98 16.108.10–13: ἔπειτα μοτοῖς τιλτοῖς ἐκπληρῶσαι τὴν διαίρεσιν καὶ ἐπιδέσμῳ καταλαβεῖν . . . εἴτα μοτοῖς κηρωτῇ ῥοδίνῃ ὑγρᾷ βεβρεγμένοις χρῆσθαι.

99 *Intro. or Physician* 14.795K = 20.6 Petit.

100 Other than its presence in Pseudo-Galen, I find no mention of a μοτὸς πριαπισκωτός in the sources. Rather πριαπίσκος alone appears. See: Galen, *Cmpds. by Place* 12.692K

types were comprised of cloth or lint of linen, probably wool, and even animal hair,¹⁰¹ it is not clear precisely how they differed. One can, for example, readily envisage a *motos* in the form of a phallus, but how did it differ appreciably from the στρεπτός type;¹⁰² or again how was it distinguished from the ἔλλυχνωτός, which, while clearly ‘made of lamp wick lint’, seems also to have been, at least sometimes, phallus shaped.¹⁰³

-
- [Heracleides], Oribasius, *Coll. Med.* 44.20.72 [Antyllus and Heliodorus], and Paul 3.24.8 (compressed from Galen, *Meth. Healing* 10.889K = J-H 3.340–341) where we find *priapiskos* as a plug for nosebleed: χαλκίτην λεάνας ἀνάλαβε δεδευμένῳ ὕδατι ἔλλυχνίῳ ἢ πριαπίσκῳ. The same passage shows ἔλλυχνιον substituted for ἔλλυχνωτός μοτός.
- 101 Erotian, *Hippocratic Glossary* 50.15–16 (ἄχνη ὀθονίου· τὸ παρ’ ἡμῖν λεγόμενον ξύσμα, ἐξ οὗ γίγνεται ὁ καλούμενος μοτός); Epiphanius Constantiensis = St. Epiphanius of Salamis (Cyprus), *Measures and Weights (De men. et pond.*, ed. Moutsoulas) 11.200–203 (μοτός . . . ὅ ἐστι λινούν ῥάκος εἰς λεπτόν καὶ μακρὸν σχῆμα ἀποτμηθέν . . .); Galen, *Meth. Healing* 10.320K = J-H 2.24–25 (εἴτ’ ἀναλαμβάνεσθω τοῦτο [sc. φάρμακον] λαγωαῖς θριξὶ ταῖς μαλακωτάταις . . . τὸν ἐκ τριχῶν μοτὸν ἐπιθεῖν). We find woolen *mota* attested in the *Hippocratic Corpus (Diseases of Women* 8.186.5L) but, oddly, only in veterinary treatises under the Empire; see, e.g., *Hippiatrica Ber.* 34.20.12: μότους δὲ ἐρίων πιναρῶν ποίει, βρέχων ἐν μέλιτι (opisthotonos) and 47.1.5: καὶ μότα ποιήσας ἔρια διάβροχα οἶνω καὶ ἐλαίῳ ἐντίθει (chest wound). On the other hand we sometimes find wool and *motos* in close proximity (Dioscorides, *Euporisa or Simples* 1.205.1: ἔμπλασσε εἰς μοτὸν ἢ ἔριον) and there is no apparent reason why wool should not have served as well as lint in human surgery. It is possible that ἀντί in Aëtius 16.48.10 equates a tuft of wool and a *motos*: ἐρίῳ ἀπαλῶ ἀντί μοτῶν ἀναλαβῶν ἐπιτίθει (ulcerous cancer).
- 102 Galen equates the *streptos* type (*Hippocratic Glossary* 19.97K) with a singular reference in the Hippocratic *Gynecology* to a *motos* called a *katheter*, said to be made of coarse linen or raw flax (*Diseases of Women* 8.157.9L). As it is compared in *Diseases of Women* to the tube used in draining empyema, Galen may have understood the *streptos motos* to be fashioned hollow.
- 103 Clearly ἔλλυχνωτός refers to material as in Galen, *Meth. Healing* 10.889K = J-H 3.340–341: ὁ [μοτός] ἐκ μαλακῶν ἔλλυχνίων (“of soft lamp wick lint”). On the other hand, form/shape may at least be sometimes involved: e.g. Galen (*Cmpds. by Place* 12.692K) records this remedy among those for nosebleed (I have modified the punctuation): “Or when you have ground a moderate amount of rock-alum, make a twist of lamp wick lint and place it in cold water; then roll it in the rock-alum. Either insert [it as] a *priapiskos* in the nostrils or use the split *motos*, thrusting it as far inside as possible:” ἢ χαλκίτην λεάνασα συμμέτρως καὶ συστρέψασα ἔλλυχνιον καθὲς εἰς ψυχρὸν ὕδωρ, εἴτα κυλίσσασα ἐν τῇ χαλκίτιδι, ἢ πριαπίσκῳ ἐντίθει ἢ τῷ σχιστῷ μοτῷ χρῶ, ὡς ἐσωτάτῳ προσερείδουσα. If I correctly understand this text, the *priapiskos* to be inserted is the lamp wick twist; thus, they are one and the same. Cf. also Paul 6.25.3, where Francis Adams renders ἔλλυχνωτός as “resembling the wick of a lamp”; that is, as indicating form not material.

Again, what separated the ξυστός and τιλτός types, both of which clearly were tufts of lint and sometimes seem equated in the literary sources.¹⁰⁴

Seeking further data as to shape and texture, we find that *mota* could be made long (μοτὸν μακρόν: Galen, *Cmpds. by Place* 12.692K), split (σχιστώ μοτῶ: Galen, *Cmpds. by Place* 12.692K), folded (μοτοῖς συμπεπτυκοῖς: Aëtius 16.48.47), fine (λεπτῶ μοταρίῳ: Paul 6.28.1), and narrow (μοτῶ στενῶ: Paul 7.24.2).

We have the same difficulty making distinctions between *mota* and what might be distinct other categories. For example, though the pledgets called *lemniskoi* (see above) could be viewed as a separate class in some testimonia,¹⁰⁵ Galen and others readily equate *mota* with them,¹⁰⁶ and Dioscorides once associates *mota* with the type called *balanoi*.¹⁰⁷ *Motos*, it seems, was a general term covering several dressings to judge by Paul 6.90.8, where a piece of linen rag (ράκος ἀπλοῦν λινοῦν), a folded compresses (πτυκτὸν διπλοῦν), and a woolen *krokus* (μικρὰν ἐρίου κροκύδα) are all classed as *mota*. (See also *prostheta* below.)

As to function, *mota* were placed on or in sores, ulcers, wounds, and, in particular, surgical incisions; they could be inserted into the body's orifices: specifically the mouth, nose, ear, and vagina.¹⁰⁸ In the main they served as packing, to maintain retraction, as a bandage or dressing (sometimes protected or stabilized by a guard/μοτοφυλάκιον, or

104 For example after lancing parulis, Aëtius 8.26.9 packs the incision μοτῶ ἢ ξύσματι ὀθονίου, “with a *motos* or shavings of linen cloth.” Cf. also Erotian, *Hippocratic Glossary* 50.15–16 (ἄχρη ὀθονίου· τὸ παρ’ ἡμῖν λεγόμενον ξύσμα, ἐξ οὗ γίγνεται ὁ καλούμενος μοτός). These shavings seem the same as those Galen inserts for bleeding at *Comm. Hipp. Surgery* 18b.808K: μοτοῖς πληροῦμεν . . . ἐνθέντες ὀθόνας τιλτάς ἃς ὀνομάζουσι μοτούς (“shredded linen cloth that they call *mota*”). Similarly, see Aëtius 7.92.18 with Galen 18b.808K (τιλτά ὀθόνια), Aëtius 8.26.9 (ξύσματι ὀθονίου), Paul 6.5.1 (διαμοτώσαντες ξηροῖς τιλοῖς) and Cassius Felix 17.3 (*super tiltario*) and 18.6 (*tilto locum calcabis* . . .)

105 E.g. Paul 6.34.3: “. . . if the abscess is small and there was only one incision, we apply a simple pledget (ἀπλῇ διαμοτώσει); if it was large and there were multiple incisions, we draw through them a *lemniskos* that can easily be extracted (διάσυρτόν τινα λημνίσκον).” See as well Aëtius 6.1.41–43 [Leonides]: οὐ δεῖ δέ, ὡς ἐπὶ ἀποστημάτων . . . λημνίσκους διεκβάλλειν, ἀλλ’ αὐτάς μόνας τὰς διαιρέσεις τοῖς μοτοῖς διαστελλεῖν. In the latter passage I take the article τοῖς as referring μοτοῖς back to λημνίσκους.

106 Galen, *Hippocratic Glossary* 19.97K (ἐμπύους μοτούς· τοὺς στρεπτοὺς ἢ τοὺς λημνίσκους). See also Paul 6.91.2 (. . . λημνίσκοις ἐκ μοτῶν χρισθεῖσιν θεραπεύειν). Epiphanius Constantiensis = St. Epiphanius of Salamis (Cyprus), *Measures and Weights* (*De men. et pond.*, ed. Moutsoulas) 11.200–203 (λημνίσκος ὑπ’ αὐτῶν τῶν ἱατρῶν καλῶς ἐκλήθη διὰ τὸ λιμνάζειν τὸν κλυζόμενον μοτόν . . .)

107 *Mat. Med.* 1.106.3 (αἱ δὲ Σαρδιαναὶ βάλανοι, ἃς τινες . . . ἢ μότα ἢ Διὸς βαλάνους καλοῦσι . . .).

108 Nose (Galen, *Cmpds. by Place* 692K [Heracleides of Tarentum]); ear (Paul 6.23); mouth (Aëtius 8.26.9; Paul 6.28.1); vagina (Aëtius 16.89.30 & 108.10–46).

by a piece of linen cloth), and to deliver medication.¹⁰⁹ Like other suppositories, they were sometimes attached to a thread/cord for binding or withdrawal.¹¹⁰

Sometimes *mota* were unmedicated (ξηρός; Galen *Cmpds. by Kind* 13.501K; Paul 6.82.1.29 & 90.4); but in the main they were moistened with substances ranging from compounds of human or asses milk, rose and olive oil (Aëtius 16.45.21), melilot, rose oil and water or human milk (Aëtius 16.45.26–27), and pine bark and wax (Paul 4.40.2) to simpler applications such as wet rose oil salve (Aëtius 16.108.12), wine (Paul 3.81.2 and passim), and brine (Paul 4.43.1). More colorful prescriptions involve human urine (Galen, *Simples* 12.286) and animal dung mixed with vinegar ([Dioscorides], *Euporista* or *Simples* 1.198.1).

There are over 150 references in Imperial literature to *mota* or to μοτῶ and διαμοτῶ, verb forms expressing their use. A selection of situations in which they were applied includes:

Paul packing a carious tooth prior to extraction “with a fine motos” (6.28.1: λεπτῷ μοταρίῳ).

Paul arresting hemorrhage after amputation διαμότοις (6.84.1).

Herakleides arresting nosebleed by inserting a long *motos* soaked in dyer’s buckthorn into the nostril(s) and applying pressure with fingers.¹¹¹

Oribasius on breast surgery for abscess: “... cut around the moist flabby parts as you would with other abscesses and apply *mota* in the same way; but, if [the operation] takes several incisions, use *mota* here too, taking care in all situations, but especially in the case of breasts, not to wedge [the *mota*] in, for fistulas arise from this. Rather place them gently along the sides [of the incisions].”¹¹²

Galen treating inflamed lesions on toes: “I myself have often effected cures with urine in the cases of slaves and country folk, when they were going away on a journey without a doctor.

109 Paul 7.17.36: μίξας... καὶ χρῶ ὡς τῷ διὰ χάρτου διὰ τε πυουλκοῦ καὶ διὰ μοτοῦ.

110 Withdrawal from vagina (Aëtius 16.108.29–43: ἔχοντα ἐξ ἄκρου λίνον ἀπηρητημένον... εἰς ἐπισπασμὸν εὐχερῇ... σπαρτίῳ ἀποδήσας).

111 ἢ μοτὸν μακρὸν δεύσασα τῷ λικίῳ ἔνθες (Galen, *Cmpds. by Place* 12.692K). For *diamota* as hemostats in amputation of the extremities, see Paul 6.84.1 (στήσας τὴν αἰμορραγίαν διαμότοις). On the other hand Soranus cannot stop uterine hemorrhage with *mota* (3.40.2 Ilberg = BGM 3.12.9–12).

112 *Ecl. Med.* 137.1 (copied by Aëtius 16.39.15–21): τὰ μὲν πλαδαρὰ περιαίρει σώματα ὡς ἐπὶ τῶν λοιπῶν ἀποστημάτων, καὶ διαμότου ὡσαύτως· εἰ δὲ τινὰς ἐπιδέχοιτο διαιρέσεις, καὶ διαμοτώσει θεράπευε, φυλασσόμενος ἐπὶ πάντων, μάλιστα μέντοι ἐπὶ μασθῶν, σφηνοῦν τοῖς μοτοῖς (ἐκ τούτου γὰρ συρριγγοῦνται), ἀλλὰ πρῶως παρατιθέναι.

I would place a *motos* on the lesion, wrap and fasten it with a piece of linen and, whenever they felt like urinating, I told them to direct the urine along the toe . . .”¹¹³

Galen reminding Glaucon of a procedure he says Glaucon has often seen him use when dealing with a subcutaneous ulcer called *kolpos*: the injection of a compound of rose oil and burnt papyrus by means of a wide bored *puoulkos*. To keep the injection in place he plugs the mouth of the *kolpos* “with a *motos* of shredded lint.”¹¹⁴

Paul performing the risky operation called periscyphismos, that is, severing the integuments of the head transversely from temple to temple and scraping the bone. “When the bone is laid bare, I will separate the ends of the vessels and the lips of the incision with plenty of wedges or *mota*.”¹¹⁵

Unlike *balanos*, *pessos* and *lemniskos*, the term *motos* is not found in Latin writers of the Early Empire. Occasionally, though one finds descriptions of a tent, or pledget that seems the equivalent. Celsus, for example, rejects for fistula insertion of “lint in the form of a collyrium stick dipped in honey.”¹¹⁶ Again, for earache he keeps instilled medication in place with a soft wool plug (6.7.1D: *lana mollis addenda est*) and for ulcerated nostrils he inserts medicated “linen twisted and oblong (6.8.1D: *linamentum involutum et oblongum*), language highly suggestive of the *streptos* or *priapiskotos* types of *motos* found in Greek sources. Also, as in Greek sources, Celsus packs a carious tooth and treats parulis with medicated pledgets.¹¹⁷ It seems that for *motos*, earlier Latin authorities preferred circumlocutions in their own tongue.

Motophulax (μοτοφύλαξ)

This name and its diminutive (μοτοφυλάκιον) were given to a type of bandage or ‘guard’ to keep a *motos* (or other form of plug/pledget) in place. Leonides’ account

113 *Simples* 12.286 (copied by Aëtius 2.108.10–16): . . . καὶ αὐτὸς ἰασάμην οὐρῶν πολλάκις ἐπὶ τε δούλων καὶ ἀγροικῶν ἀνθρώπων, εἰς ὁδοιπορίαν ἀπιόντων χωρὶς ἰατροῦ. μοτὸν γὰρ αὐτοῖς ἐπιθεῖς κατὰ τοῦ ἔλκος, εἴτ’ ἔξωθεν καὶ ὀθονίῳ περιελίξας καὶ δήσας ὄσας οὐρεῖν προθυμηθῶσιν, κατὰ τοῦ δακτύλου φέρεσθαι τὸ οὖρον ἐπιτρέπειν ἐκέλευσα . . .

114 *Glaucon, Meth. Healing* 11.125: καὶ πεῖτα μοτῶ τιλτῶ μύοντα τὸ στόμιον.

115 Paul 6.7.1: γυμνωθέντος δὲ τοῦ ὀστέου σφηνίσκοις ἢ μοτοῖς πλείοσι χωρίσομεν ἀπ’ ἀλλήλων τὰ τε πέρατα τῶν ἀγγείων καὶ τὰ χεῖλη τῆς διαιρέσεως ἐπιδήσομεν . . .

116 (5.28.12N): *linamentum in modum collyri compositum tinctum melle*.

117 6.9.6: *involutum in lana* (cf. Paul 6.28.1); 6.13.2: *mollis linamenti paulum involvendum* (cf. Aëtius 8.26.9).

of surgery for hydrocephaly, as transmitted by Aëtius, is descriptive. First the fluid is released and the incision dressed so as to drain (τῇ διαμοτώσει). Following this process, if the patient is an infant, Leonides applies wool imbued with eggwhite under a small cap (πιλάριον). He prefers the cap, as opposed to epidesis, the usual term for bandaging, because of the latter's weight (διὰ τὸ βάρος). In the case of 'hardier patients', a *motophulakion* is prescribed, rather than a cap, and epidesis again rejected.¹¹⁸ This leads one to think that a *motophulax/-akion* was lighter than the usual bandage. Unfortunately, in a second version of the procedure (15.12; cf. esp. lines 34–41) Leonides (or Aëtius' transcription?), confuses us by allowing for "a suitable bandage" applied in the case of adults after the *motophulakion* (εἴτα ἐπίδεσις οἰκεία παραλαμβανέσθω). Because epidesis is rejected in the first version, one is tempted to think that either the "suitable bandage" in the second is lighter than usual or is employed at a different (εἴτα) stage of treatment; in other words weight may yet be an issue and a *motophulakion* lighter than standard bandaging. In any case, it may be a lighter *motophulax-ion* that Oribasius refers to as 'common', in contrast to a *ptugmation*, a cloth folded over on itself several times that also might be referred to as a *motophulax* (see s.v. *ptugma* below).¹¹⁹

The *motophulax* might itself be medicated. Severus, for example, places a *motophulakion* soaked in sour wine and water on a pledget inserted into the incision made for arteriotomy (Aëtius 7.92.19).¹²⁰ Aëtius prescribes as postsurgical treatment for scrofulous growths (choirades) packing the incision with manna, *mota*, and then a *motophulakion* soaked in wine topped by a tuft of wool and a bandage (15.5.74–76).¹²¹

In several instances the *motophulax* seems to have simply been medication (μοτοφυλάκιον φάρμακον) and not a bandage: Paul 6.34.3.13 (applied to incision for abscess after application of a medicated *mos*), 6.62.3.22 (applied to incision for hydrocele), and 6.107.3 (applied to wound resulting from fracture). We may also consider Aëtius 7.92.32, which seems to prescribe a *motophlax* of white lead (μοτοφυλάκι δὲ χρηστέον τινὶ τῶν διὰ ψυμμουθίου).

118 Aëtius 6.1.45–46: ἐπὶ δὲ τῶν ἰσχυροτέρων μοτοφυλάκιον ἔξωθεν ἐπιτιθεσθω καὶ ἐπίδεσις ἐκκρινέσθω.

119 *Coll. Med.* 44.7.9 (*empyema*): ἔξωθεν ἐπιμοτούσθω ἡ τομὴ τιλοῖς οἰνελαῖω βεβρεγμένοις, καὶ ὁ κοινὸς μοτοφύλαξ ἐπιτιθέσθω.

120 εἴτα σφηνίσκον ἰσόμετρον τῆς τομῆς ἐντίθεμεν καὶ τιλτὰ ὀθόνια πλείστα ἐπιθέντες τῷ σφηνίσκῳ πτύγματι χρώμεθα μοτοφυλάκι ὀξυκράτῳ βεβρεγμένῳ . . .

121 πληρούσθω ἡ διαίρεσις τῇ τοῦ λιβάνου μάννῃ καὶ διαμοτούσθω ὁ τόπος καὶ μοτοφύλαξ ἐπιτιθέσθω οἶνῳ βεβρεγμένος εἴτα ἔριον καὶ οὕτως ἐπιδείσθω.

Omolinon (ὠμόλινον)

On the whole *omolinon* must have been a crude type of linen cloth, as its name and the occasional modifier suggest.¹²² Perhaps for that reason we several times see it employed as a rubefacient and in massage. In a passage that smacks of our own times Galen relates how he placed an obese man of forty on a diet and assigned a regimen of running:

Before (running), I rubbed him down with rough cloths of *omolinon* until his skin became red.¹²³

Soranus recommends toweling off and massaging a newborn with an *omolinon* after bathing (*Gyn.* 2.32.2 Ilberg = 2.12.48 BGM).¹²⁴

In this sense *omolinon* sounds similar to or identical with the *hemitubion* (see above, s.v.).

Omolinon is noticeably associated with fomentation, as when Herodotus recommends application of *omolinon* cloths or sponges soaked in hot water to pustules arising from fever (Aëtius 5.133.85 [Herodotus]).¹²⁵

Hippocratic references are mostly focused on *omolinon* folded into a plug (*motos/katheter*): a) to regulate the draining of empyema and dropsy;¹²⁶ or b) as a set of three of the type used for empyema, but graduated in thickness and anointed with goose fat, to soften a sclerotic cervix.¹²⁷ In addition, the *Corpus* is witness to very fine (λεπτότατον) *omolinon* folded over and fashioned into a cord to open a fistula by apolinosi,¹²⁸ and to its application to areas affected with sciatica and gout and fired as a cautery.¹²⁹

122 Oribasius, *Coll. Med.* 45.29.46 [Philumenus] contrasts soft rags as a cooling agent with the roughness of *omolina*.

123 ... ἀνατρίβων μὲν πρῶτον ὠμολίνοις τραχέσιν ἄχρι τοῦ φοινίξαι τὸ δέρμα... (*Meth. Healing* 10.995K = J-H 3.498–499). Cf. also *Cmpds. by Place* 12.423K.

124 For massage with *omolinon* see also Soranus, *Gyn.* 3.44.5 Ilberg = 3.13.73 BGM (female flux); Archigenes, *Frag. Ined.* 71.24; Oribasius, *Coll. Med.* 6.6.4 (insomnia).

125 See also Oribasius, *Ecl. Med.* 115.2 (itching pustules) and *Syn.* 9.11.5 = *Eunap.* 4.85.4 (flatulence).

126 *Diseases* 2.47, 2.60, 2.61 (here said to be παχύν and ἔπακρον), and 3.16 (line 143 Littré); *Internal Affections* 9 and 23P.

127 *Diseases of Women* 8.157.9–15L.

128 *Fistulas* 4P.

129 *Affections* 29 & 31P.

Othone (ὀθόνη) with Diminutive *Othonion* (ὀθόνιον)¹³⁰

These are the most frequently used terms for linen cloth or lint in Greek surgical texts.¹³¹ The references are so frequent that it is impossible to consider more than a representative number. Clearly an ample supply of this material was essential to even a moderately stocked surgery.

As with other terms denoting both lint and cloth it is not always clear which is meant by *othone/othonion*. Modifiers like light, fine, soft, clean, new and dry, unless elucidated by context, are not much help in making the distinction.¹³² On the other hand broad, thick, slender, strong, smooth, really rough, and folded double, multiple times, or simply used in a single sheet, must refer to cloth,¹³³ while “shavings of *othone*” or “*othonion tilton*” clearly refer to lint.¹³⁴ Unfortunately, such qualifiers are few in comparison to the vast number of references.

In the main, aside from its use as a bandage or sling, *othone/othonion* was employed as a means of applying medication and as a medicated dressing or pledget/plug. In the latter case it might be combined with other materials, as when Soranus covers leech bites with lint (τίλματα), *othonion* and then wool (*Gyn.* 3.11.7 Ilberg = 3.2.172–173 BGM), or when Andromachus packs a wound/ulcer with medi-

-
- 130 There generally seems little difference, even in size, between the two forms. Note how they interchange in identical passages at Galen, *Cmpds. by Kind* 13.665 & 666K: δι' ὀθονίου μαλακοῦ . . . ; δι' ὀθόνης μαλακῆς . . . or at Galen, *Simples* 12.364K or again at Galen, *Cmpds by Kind* 13.685 (copied by Oribasius, *Coll. Med.* 46.36.33).
- 131 I find one reference to woolen (ἐρίνεον) *othonion* (Alexander of Tralles, *Therap.* 1.567.18). Owing to the frequency of its use, the term *othonion* must have become virtually synonymous with 'cloth'; hence the occasional need to specify material, as [Hippocrates] *Fistulas* 3P (ὁθ. βύσσινον), Pseudo Galen, *Drugs Easily Procured* 14.553K (ἐν ὀθόνη λινῇ).
- 132 Examples: Galen, *Comm. Hipp. Surgery* 18b.790 & 881K (ὁθ. κουφά, λεπτά, μαλθακά, καθαρά); Galen, *Cmpds. by Kind* 13.665K (δι' ὀθονίου μαλακοῦ τε καὶ καθαροῦ καὶ ξηροῦ) and *Cmpds. by Place* 12.793K (ὁθ. ἀπαλόν); Oribasius, *Coll. Med.* 10.34.4 (ὁθ. καινόν); Dioscorides, *Mat. Med.* 3.83.3 (εἰς ὁθ. καθαρόν ἀραιόν).
- 133 Examples: Galen, *Comm. Hipp. Fractures* 18b.498 & 547K (ὁθ. πλατύτερα); Pseudo-Galen, *Drugs Easily Procured* 14.486K (ὁθ. ισχνά); Oribasius, *Coll. Med.* 46.30.2 (ὁθ. τραχυτάτῳ); Oribasius, *Syn.* 3.21.1 (ὁθ. πυκνήν); Galen, *Meth. Healing* 10.703K = J-H 3.64–65 (ὁθ. διπτύχον); [Dioscorides], *Euporista* or *Simples* 1.235.2 (διπλοῦν ὁθ); Dioscorides, *Mat. Med.* 4.150.4 (τριπλοῦν ὁθ.); Galen, *Cmpds. by Kind* 13.598 (πολυπτύσους . . . ὁθόνας, copied by Paul 4.54.7.13); Oribasius, *Ecl. Med.* 8.1 (ὁθ. πολύπτυχον); Galen, *Cmpds. by Kind* 13.733K (ἀπλοῦν); Galen, *Cmpds. by Kind* 13.685K (ισχυρόν τὸ ὁθ.); [Hippocrates] *Hemorrhoids* 2P (ὁθ. λεπτόν καὶ λείον).
- 134 E.g., Aëtius 3.64.3 (ξυσμάτια ὀθόνης, treating exomphalos in children) and 7.92.18 (τιλτὰ ὀθόνια, in arteriotomy [Severus]).

cation surmounted by *othonion* moistened with water, a soft sponge, and a linen bandage (ἐπιδέσμων ... ἐξ ὀθόνης) covering the whole (Galen, *Cmpds. by Kind* 13.685). Attracting notice is the combination of rabbit fur (called a *motos*) bound with *othone* to prevent hemorrhage while injured blood vessels are treated (Galen, *Meth. Healing* 10.320K = J-H. 2.25; reproduced by Oribasius, *Syn.* 7.20.4 & *Eunap.* 3.36.4). More mundanely, a plug of *othonion* might be used as a stopper for a vessel (Aëtius 1.113.4, making rose oil).

The following random examples from Galen, Oribasius, and Aëtius, arranged *a capite ad calcem* with a sample of medications, give an idea of the range of such applications.

Head: with oil of iris, sulphurwort, castor, etc., after shaving of hair, to relieve headache (Galen, *Cmpds. by Place* 12.558 & 581K [Charicles]); imbued with realgar to combat alopecia (Galen, *Cmpds. by Place* 12.404K [Cleopatra]).

Eyes: with calf marrow, and rose oil for stiff and immobile eyelids (Oribasius, *Eunap.* 4.30.1); with Crito's Synthetic for bruised and black eyes (Aëtius 8.2.38).

Nose: black cummin wrapped in *oth.* and inhaled to treat catarrh (Galen, *Simples* 11.860K).

Mouth: soft *othone* as packing for gums and to prevent slippage of fingers while a tooth is filed (Galen, *Cmpds. by Place* 12.872K, copied Aëtius 8.32.10–15).

Abdomen/haunch: applied with henbane etc. to belly for diseases of bowels and dysentery (Galen *Cmpds. by Place* 13.306); with fenugreek, honey, etc. to hips for sciatica (Galen *Cmpds. by Place* 13.345K); with oil mixed with wine and vinegar, rose oil, etc., to stomach for 'kitta' = longing for odd foods in pregnancy (Aëtius 16.10.58 [Galen]); with maidenhair (*adianton*), vinegar, celery juice, etc., for 'gonorrhea' (Aëtius 11.33.55 [Galen]); with oil and wine or rose oil salve to stomach for heatstroke (Aëtius 4.47.28).

Genitalia: with *Cyperus rotundus*, sodium carbonate, saffron, and honey as a vaginal suppository to promote conception (Aëtius 16.34.16 [Asclepiades]); moistened with water and placed between glans and prepuce to prevent postsurgical adhesions in phimosis (Oribasius, *Coll. Med.* 50.6.3 [Antyllus] = Paul 6.56.1).

Anus: with orange acacia, lead and tragacanth for hemorrhoids (Oribasius, *Eunap.* 4.95.5).

Joints: with saffron, opium, etc. to relieve gout and athritic pain (Galen, *Cmpds. by Place* 13.355K; similarly Oribasius, *Eunap.* 4.116.16).

Other functions of *othone/othonion* include fomentation,¹³⁵ as a rubifacient,¹³⁶ and as a hemostat.¹³⁷

We also find testimonia to the use of both in the preparation of medications¹³⁸ and, when burnt, as an ingredient in them.¹³⁹

When fashioned as a plug or suppository Hippocratic sources sometimes call the *othonion* used *peossos* or *prostheton*, showing that in this situation these names can be interchangeable.¹⁴⁰ So too the στρεπτον δι' ὀθόνης (plain or burnt and quenched in juice of knot-grass or leek) inserted to arrest nosebleed in Pseudo-Galen, *Drugs Easily Procured* 14.338K must be a type of *motos*.¹⁴¹

As with other terms used for linen cloth, we find *othonion* sometimes employed in attempts to cure by magic. Alexander of Tralles (*Therap.* 1.567.18 [Ostanes]) records an *othonion* wrapped amulet against epilepsy. Dioscorides (*Mat. Med.* 2.104.2) tells us that some recommend curing warts by touching them with chickpeas, then binding the latter in *othonion* and tossing them behind.

Papyrus

Dioscorides and Galen succinctly summarize those features of papyrus of interest to the medical community. According to the former:

-
- 135 See [Hippocrates], *Nature of Women* 105(1)P, *Diseases of Women* 8.193.13L (flux); [Dioscorides], *Euporista or Simples* 1.234.1 (sciatica, etc.); Oribasius, *Coll. Med.* 10.27.15 (facial swelling).
- 136 Pseudo Galen, *Drugs Easily Procured* 14.329 & 330K: ὀθόνη προανατρίψας ἕως οὗ ἐρυθρὸν γένηται.
- 137 Aëtius 3.22.9–10 (after leeching [Antyllus]); Aëtius 9.42.189 (after phlebotomy for dysentery [Didymus]).
- 138 Galen, *Simples* 11.877K (binding a lozenge of hedge mustard and fat for roasting); Dioscorides, *Mat. Med.* 4.150.4 (folded three ply in refining squirting cucumber by positioning over ashes); Galen, *Cmpds. by Place* 13.39 & 42K (wrapping and boiling poppy capsules with other ingredients [Heras, Soranus]); Dioscorides, *Mat. Med.* 5.16.1 (wrapping and steeping the drink thumoxalme); Galen, *Simples* 12.364K, copied by Aëtius 2.174.9–12 (killing cantharides/blister beetles by steaming them thru *othon.*).
- 139 [Dioscorides], *Euporista or Simples* 1.179.1 (astringent for ulcers); Oribasius, *Syn.* 7.6.5 (burnt with dove dung for burns/inflammations, copied by Paul 4.11.2); Aëtius 8.17.11 (for bad breath), Aëtius 9.42.189 (after phlebotomy for dysentery [Didymus]). For veterinary treatises see *Hippiatrica Ber.* 11.16.1.
- 140 Aëtius 16.34.16 (*peossos* to promote conception [Asclepiades]); [Hippocrates], *Places in Man* 47P (where the *prostheton* is said to be fashioned like a *balanos*), *Diseases of Women* 8.78.68 & 141L.
- 141 Cf. Oribasius, *Ecl. Med.* 17.1.3: μότω ἢ ξύσματι ὀθόνης (parulis).

Everybody knows about papyrus from which sheets are made [for writing]. But it can be used in medicine [too], when prepared for dilating fistulas by being thoroughly moistened, wrapped with linen and then dried. When compressed and inserted, it absorbs the moisture, swells up and opens the fistulas.¹⁴²

Galen expands on this:

Soaked or burnt it becomes useful. When soaked in sour wine and water or just wine it knits fresh wounds/ulcers, especially when arranged around them in a circle. . . . When burnt it now becomes a drying agent, just as the ash of its sheets when burnt, except that the ash of the plant is weaker.¹⁴³

References in the literature copy or echo these summaries. Celsus (5.28.12K) before, and Oribasius (*Coll. Med.* 10.23.8 & 44.21.7[Meges]), Cassius Felix (20.3) and veterinarians after Dioscorides (e.g., *Hippiat. Cantabrig.* 100.7) document the utility of papyrus in treating fistulas.¹⁴⁴ Its effectiveness in knitting lesions, when soaked in wine and water, is copied by Oribasius (*Syn.* 7.1.4; *Eunap.* 3.13.4) and Paul (4.37.1). Likewise, we see its ash noted as a drying agent in general lists provided by these same authors: Oribasius *Coll. Med.*, 14.23.3, *Eunap.* 2.5.3 and Paul 7.3.15–16. They too emphasize the greater effectiveness of the ash of papyrus sheets as opposed to the plant itself.¹⁴⁵

There are far too many references to the use of papyrus sheets and ash to consider, whether employed independently or mixed with other materials. Here are a few examples:

In the mouth: application of ash for ulcers, loose teeth and gum disease (Celsus 6.15.1; Dioscorides, *Mat. Med.* 1.86.1; Galen, *Cmpds. by Place* 12.88o [Pythias] and 881K [Crito]).

On the head: application of ash for alopecia (Celsus 6.4.3), dandruff and melicera (Oribasius, *Eunap.* 4.12.11; Aëtius 6.68.41; Paul 3.3.4).

142 πάπυρος γνώριμος πάσιν, ἀφ' ἧς ὁ χάρτης κατασκευάζεται, εὐχρηστος δὲ εἰς τὴν ἰατρικὴν χρῆσιν, πρὸς ἀναστόμωσιν συρίγγων σκευασθεῖσα διάβροχος περιειλουμένου λίνου ἄχρι ξηρασίας· στεγνουμένη γὰρ καὶ καθιεμένη ἐμπίπλεται ὑγρασίας καὶ ἐξοιδοῦσα διανοίγει τὰς σύριγγας (*Mat. Med.* 1.86.1).

143 βραχεῖσα δὲ ἡ καυθεῖσα χρησίμη γίγνεται. ὀξυκράτῳ μὲν οὖν ἢ οἴνῳ βραχεῖσα κολλᾷ τὰ πρόσφατα τῶν ἐλκῶν καὶ μαλιστα ἐν κυκλῷ περικειμένη . . . ἐπειδὴν δὲ καυθῇ, φάρμακον ἤδη γίγνεται ξηραντικόν, ὥσπερ καὶ ἡ τέφρα τοῦ κεκαυμένου χάρτου, πλὴν ὅσον ἀσθενεστέρα ἐστὶν ἢ τῆς παπύρου (*Simples* 12.94K).

144 Including fistula in animals: *Mulomedicina Chironis* 88, 92 & 96.

145 So also Galen, *Simples* 12.94K.

To the genitals: application of ash for ulceration (Paul 4.44.5).¹⁴⁶

Gynecological applications: placement of sheeting moistened and medicated to breasts excessively enlarged with milk at childbirth (Oribasius, *Ecl. Med.* 141.1); placement of sheeting moistened with oil and bound over the abdomen to prevent post partum wrinkles and discoloration or 'melanias' (Aëtius 16.124.12–16 [perhaps deriving from Crito who had an interest in such cosmetic formulas; see Galen, *Cmpds. by Place* 12.447K]).

General: application of sheeting used as hemostats after leeching (Oribasius, *Syn.* 1.15.4; Aëtius 3.22.11).

Of special relevance are the following instances of papyrus or medicament of its ash being cited in connection with instruments.

An ash compound injected by clyster for dysentery: Galen, *Cmpds. by Place* 13.295K (Isidore) and Paul 7.12.1.15.

Ash injected with rose oil by catheter for ulcerated bladder: Aëtius 11.29.60–62 [Rufus].

An ash compound injected with a straight tube of copper alloy or horn, or with a *puoulkos* for fistula: Galen, *Glaucon, Meth. Healing* 11.125K.

Papyrus soaked in juice of draconteum, wound around a probe (*specillum*) and inserted into the nose for polyp: Marcellus Empiricus, *De Med.* 10.58.

Soft, elastic strip of papyrus sheeting (ἵνα χάρτου μαλακὴν καὶ εὐτόνον) wrapped around the penis and used with a small leaden tube (*solenidion*) to enlarge the foreskin: Galen, *Meth. Healing* 1000–1001K = J-H 3.506–509.

Papyrus moistened and wrapped around a tube (*solenarion*) for insertion into the urethra to keep the passage open after surgery for occlusion. Papyrus prepared in this way is called an *ipoterion*. See above s.v.

¹⁴⁶ Marcellus Empiricus records a curious remedy for bloody nose: papyrus fastened to the tip of the male member (*De Med.* 10.43).

Penicillus-um

Yet another term commonly found in Latin sources in situations where a pad, a plug or a suppository (medicated or otherwise) is called for, or where cleansing is required. It is therefore usually translated as such and assumed to be composed of linen, or wool, or of the lint of these materials.¹⁴⁷ In keeping with this rendering one notes that Celsus several times couples *penicillum* with *linamentum*, indicating that, as either would do in the same situation, they should be quite similar items.¹⁴⁸ Indeed, when Celsus recommends a *penicillum* that is fine/thin (*tenue*), one first thinks of cloth or lint. But Pliny tells us of a type of fine, soft sponge bearing the name *penicillum*, and this he connects with care of eye conditions and, smeared with hot cumin, as a treatment for colic.¹⁴⁹ No surprise then that *penicillum* and sponge are equated in the medical section of the later glossary called *Hermeneumata Monacensia* (207.50 *spongo penicillum*). Once it is established that *penicillum* as sponge had medical applications, it strikes one that there are few contexts in Celsus and the other authorities writing in Latin where we cannot at least allow for *penicillum* as a sponge or a suppository or plug of sponge, as opposed to cloth or lint.

A *penicillum* was deployed in many of the surgical and parasurgical situations where in Greek we might expect a *motos*, a *pessos*, etc. If it be true that a *penicillum* was often or generally sponge, the chief distinction among these terms would have less to do with use than with the material used.

Usages in Celsus include: 2.10.18 (hemostat after cupping); 7.10.1 (medicated plug as a hemostat after removal of nasal polyp); 3.10.4 (cleansing the tongue in fever); 6.6.8E 6 & 6.6.9b (cleansing or fomenting the eye in ophthalmia); 5.28.12K & 7.4.4c (medicated suppository for fistula); 6.8.2b (medicated suppository for nasal polyp); 6.6.8B (to instill milk or egg for ophthalmia); and 8.9.1H (suppository attached to a thread and inserted into drained pus pocket in wake of fractured rib after cauterization of same).

A *penicillum* could also be used to support or maintain position. When nasal cartilage is broken, Celsus first raises it with a probe or finger. Then:

147 For Celsus see Spencer's various renderings and the entries in dictionaries such as that of Lewis and Short, and the Oxford Latin Dictionary.

148 6.8.2B (fistula); 7.10.1 (nasal polyp); 8.9.1H (pus pocket).

149 *Nat. Hist.* 9.148 (thin with close texture, called Achilles, for paintbrushes), 20.162 (applied hot and bandaged in place for colic), 31.125 (fine and soft for eyes). He names the source (or one source) for this special sponge as Lycia (31.131).

linen cloth/lint fashioned lengthwise and enclosed with soft hide sewn around should be introduced; or in the same manner something made up of dry *penicillum*...¹⁵⁰

In the same category we may also place 7.7.6B (separating adhering eyelids).

Among other authors Scribonius Largus wipes away medication for warts, piles, etc. with a *penicillum* (*Comp.* 228), and Marcellus Empiricus inserts a medicated version anally for constipation (*De Med.* 28.3).

Cassius Felix also records some of these applications, as well as others taken from sources of ‘dogmatic’ persuasion.¹⁵¹

Lastly, Latin inscriptions also record *penicillum* as an ingredient in eye salves.¹⁵²

***Pessos* (πεσσός, dim. πεσσάριον, Transliterated in Latin as *pessus-um* with Diminutive Forms *pessulum*, *pessarium*)**

Like the *balanos* (see above) a suppository, plug, or ‘pessary’ but limited to female conditions. So Celsus (5.21):

But there are also other useful applications, such as those inserted into the female organs. The Greeks call them *pessoi*. Their main feature is this: a mixture of medications is enclosed in soft wool and the wool is then inserted into the vagina.¹⁵³

There are exceptions to what Celsus tells us. *Pessoi* might be applied to both sexes in cases of stone and colon complaint.¹⁵⁴ Nor was wool always required; as with *balanoi*, sometimes the ingredients themselves were sufficient. For inflamed uterus Aëtius prescribes a previously stored concoction of fenugreek and goose or bird fat.

150 *deinde in longitudinem implicata l<i>namenta et molli pellicula cincta circumсутaque intus adigenda sunt; aut eodem modo compositum aliquid ex arido penicillo* (8.5.1).

151 Eye disease (29.3, 5 & 17), nosebleed (30.2), to throat, mouth and nostrils for dry cough (34.2), to mouth and nostrils for synanche (37.5), raw/fresh [*rudes*] and very soft [*molliores*] applications after leeching for edema (75.3).

152 *Corpus of Latin Inscriptions*: 7.1312; 13.10021.25 & 112.

153 *Sed alia utilia quoque sunt, ut ea quae feminis subiciuntur: pessos Graeci vocant. Eorum haec proprietas est: medicamenta composita molli lana excipiuntur; eaque lana naturalibus conditur.*

154 Pseudo-Galen, *Drugs Easily Procured* 14.473 (πρὸς λιθιῶντας) and 14.470K (rectal application: πρὸςθετον κωλικῶς).

When you use it, soften it with the plate of a spatula probe on your hand, take it up as a *pessos* and apply.¹⁵⁵

According to Antyllus, *pessoi* for uterine conditions were divided into three classes: those intended to soften or soothe (μαλάσσουν), those intended to contract or act as astringents (στυφουσιν) and those intended to open or dilate (ἀναστομοῦσιν).¹⁵⁶ The first dealt with inflammation, ulceration,¹⁵⁷ cooling, strains/displacements, and flatulence, the second with checking flow,¹⁵⁸ and countering looseness/expansion and prolapse, while the third class was intended to promote cleansing/evacuation,¹⁵⁹ and to correct closure and contraction.¹⁶⁰ Aëtius 16 lists some of these situations and adds others: uterine mole (75.48) and dropsy (74.57–59), miscarriage (21.10), and a test with a *pessos* of garlic for capacity to conceive (7.13).¹⁶¹

References in Latin authors are few. Pliny recommends a pessary of wool imbued with laser (distilled from silphium) to promote menstruation (*Nat. Hist.* 22.101).¹⁶² Caelius Aurelianus and Cassius Felix mention several applications for female conditions: Caelius in treating satyriasis (*Acut. Diseases* 3.18.184) and bladder conditions (*Chron. Diseases* 5.4.70), Cassius for bladder and uterine complaints (46.13; 78.2–6), and hysteria (79). In the latter case the *pessus* is described as “shaped like a large Egyptian bean or a filbert nut.”

Pessoi for contraception and abortion are attested as early as the famous reference in the *Hippocratic Oath* (4.15L) to which we may add: [Dioscorides] *Euporista or Simples* 2.100.2 (copied by Oribasius, *Eunap.* 4.114. 2), and Pseudo-Galen, *Drugs Easily Procured* 14.481K. The latter source also provides a *pessos* for regulation of vaginal lubrication (14.486K: καὶ ἔσται ὡς παρθένος ἐν τῇ συνουσίᾳ. See also below under Wool).

Like clysters *pessoi* might be harsh, gentle, hemagogic etc. and, like *balanoi*, they varied in size and shape.¹⁶³

155 16.79.6: ἐπὶ δὲ τῆς χρείας, τῷ πλάτει τῆς σπαθομήλης μαλάσσω ἐπὶ τῆς χειρὸς καὶ πεσσὸν ἀναλαβὼν, ἐπιτίθει.

156 Oribasius, *Coll. Med.* 10.25.1 [Antyllus]; Paul 7.24.1.1–3.

157 Also Oribasius, *Syn.* 3.39.3.

158 Also Dioscorides, *Mat. Med.* 5.4.2.

159 See Soranus, *Gyn.* 3.13.1 Ilberg = 3.2.209–215 BGM. Some of his ingredients: warm sweet olive oil, linseed, mallow, goose or bird fat, egg yolk, and honey. See also Galen, *Simples* 11.769K.

160 Sclerotic womb may fall into the category of contraction (Pseudo-Galen, *Drugs Easily Procured* 14.484K).

161 We even find *pessoi* promoting conception in horses in *Hippiatrica Cantabrigiensia* 10.12.3.

162 The word *pessus* is not used but it is clear what Pliny means: *lanis mollibus admovetur vulvae ad menses ciendos*.

163 Aëtius 16 is a rich source of terms for harshness, etc: δριμύτεροι (75.48), αἰμαγωγοί (74.53; also Soranus, *Gyn.* 4.15.1 Ilberg (αἰμαγωγὰ πεσσάρια), μαλακτικοί (74.61), πρᾶότεροι (72.65),

Prostheton (προσθετόν, sc. φάρμακον)

A general term for any molded medication¹⁶⁴ or medicated plug or suppository inserted into an orifice of the body. This includes *balanoi*, *krokudes*, *pessoī* and *mota*. All of these terms, when of similar material and similar purpose, must have been interchangeable.¹⁶⁵ Oribasius demonstrates as much when he remarks at *Ecl. Med.* 142.8:

Also *prostheta* for promoting menstruation include juice of rue applied in a *krokus* or marjoram in a *pessos* ...¹⁶⁶

Or again Galen in his *Commentary on Hippocrates' Epidemics I* (17a.277K: Wife of Philinus):

As I remarked before, you can understand both *balanos* and *pessos* where (Hippocrates) says 'she was given a suppository (προσθεμένην)'.¹⁶⁷

See also *hupotheton* above.

Ptugma (πτύγμα and dim. πτυγμάτιον, προσπτυγμάτιον, Occasionally πτυκτον)¹⁶⁸

Technically, anything folded. In Greek medical literature a *ptugma* serves as a pledget or compress composed of a folded or rolled tuft of wool or a folded piece of linen or

παρερεθίζων (61.24). For size and shape see Oribasius, *Coll. Med.* 10.25.4 (copied by Paul 7.24.2) δεῖ... παχύτερον ποιεῖν τοῦ πεσσοῦ τὸ πάχος κάππειτα ἔριον μοτῶ στενῶ παραπλήσιον διπλοῦν ἀποβάπτειν εἰς τὸ φάρμακον καὶ προστιθέναι εἰς τὸ στόμιον τῆς ὑστέρας...

164 As the uterine *balanoi* shaped to size from a mixture of flower of copper, nitron and boiled honey prescribed in the Hippocratic work *Superfetation* 33P.

165 For the close relationship of verb forms from τίθημι with *pessos* and *balanos* see, e.g., Aëtius 16.88.23–29 (πεσσός... προσθετέον δὲ ἐν ἐρίῳ) and 16.120.6–8 (εἴτα βάλανιον προστιθέναι... ἢ τὸν... πεσσόν...).

166 καὶ πρόσθετα δ' ἐστὶν αἰμαγωγὰ πηγάνου χυλὸς ἐν κροκύδι πρόσθετος ἢ ἀμαράκινον ἐν πεσσῶ...

167 προεῖρηται δ' ὅτι καὶ βάλανον καὶ πέσσον ἐπὶ τῷ <προσθεμένη> δυνάτὸν ἐστι προσυπακούειν. This comment is repeated more expansively at 17a 270–271K. For another reference to *balanoi* as *prostheta* see Stephanus, *Commentary on first book of Galen's Glaucon, Meth. Healing* 330.22 & 25.

168 See Paul 6.90.4 & 8 [Galen] where a *ptukton* is a doubled cloth compress applied in treatment of skull fracture; also Aëtius 7.74.26–28 = Hirschberg, Waugh pp. 110–111. Chp. 74 (ectropion [Antyllus]) and 7.95.19 (angiology) where *ptukta* soaked in cold water are applied after surgery.

woolen cloth.¹⁶⁹ This may be medicated or not, and applied independently, or as a dressing on top of, or under, a plaster and other dressings. When a *ptugma* fills the function of a *motophulax*, it can be called *motophulax*.¹⁷⁰ Ingredients often soaked into *ptugmata* include egg, vinegar-water (δξύκρατον) and oil. Its range of applications includes some as mundane as acting as padding to insure proper placement of bandages (Paul 6.9.6.2 [Soranus]; 6.97.1) or to adjust lengthwise the valves of a speculum for vaginal penetration (Aëtius 16.89.13 and Paul 6.73.1: uterine abscess). *Ptugmata* are also found in veterinary texts.¹⁷¹ There are ca. 70 references to its use in Greek texts. Some examples:

Soranus, *Gyn.* 2.5.4 Ilberg = 2.1.105 BGM: Placement of a *ptugma* under the anus of a laboring gravida to prevent prolapse and rupture.¹⁷²

Soranus, *Gyn.* 2.13.4 Ilberg = 2.6a.88 BGM: Use of *ptugmation* soaked in oil applied after omphalotomy; cf. Aëtius 4.3.15; Oribasius, *Coll. Med., Lib. Inc.* 29.4 [Galen]).

Galen, *Comm. Hipp. Fractures* 18b.568K = Oribasius, *Coll. Med.* 46.1.121: Galen recounts how at Pergamon he treated the most serious gladiatorial wounds in summer “with *ptugmata* of linen cloth . . . soaked in wine topped by new soft sponges which I kept moist day and night.”¹⁷³

Aëtius 5.78.21: For intense fever place *ptugmata* of large thin linen rags along the chest and stomach [Philumenus]).¹⁷⁴

Aëtius 12.1.220: Before burning with dung for sciatica, place underneath in advance in the hollow area “a *ptugma* of wool soaked in oil [Dioscorides].”¹⁷⁵

169 We find several instances in Aëtius where wool dyed purple (ἐρέας πορφύρας) is required: see 4.19.7 and 9.33.68 [Philumenus]. In both passages the *ptugma* is placed over a mixture bound with egg and applied to the abdomen to arrest diarrhea.

170 Oribasius, *Coll. Med.* 44.7.8 and 17 (*emptyema*): εἴτα τιλοῖς μότοις χρηστέον καὶ πτυγματίῳ διπτύχῳ ἢ τριπτύχῳ, τῷ καλουμένῳ μοτοφύλακι. See also Aëtius 7.92.19.

171 *Hippiat. Paris.* 837.5: θεραπεύει δὲ καὶ κωλικούς πτύγμα ἐπιτιθέμενον κατὰ τοῦ ὀμφαλοῦ.

172 πτύγματος γὰρ ὑποθέσει τὸν δακτύλιον αὐτῆς ἀποκρατεῖν δεῖ διὰ τὰς ἐν τῇ τάσει γινομένας προπτώσεις καὶ ῥήξεις.

173 πτύγματα μὲν ὀθονίων ἐπιθεῖς τοῖς τραύμασιν οἷνῳ τοιοῦτῳ βεβρεγμένα, κατ’ αὐτῶν δ’ ἔξωθεν σπόγγους καινοὺς μαλθακοὺς, εἴτα σχεδὸν δι’ ὅλης ἡμέρας τε καὶ νυκτὸς ἐπιβρέχων.

174 πτύγματα δὲ βακῶν λινῶν εὐμεγεθέων ἰσχνῶν . . . κατὰ τοῦ στήθους καὶ τοῦ στομάχου. Similarly after evacuation in cases of ileus Cassius Felix (51.13) covers chest and stomach with *ptygmata* moistened with warm water and oil.

175 ἐρίου πτύγμα ἐλαιοβραχὲς προποθεῖς τῷ κοιλῷ τόπῳ.

Aëtius 13.2.13–15: After other applications for dogbite, “Apply a *ptugma* moistened with vinegar water and leave it on for three days. When removed you will find the bite clean.”¹⁷⁶

Aëtius 15.12.47: After surgery on adults for hydrocephaly, apply a plaster of dried sage wine. “And above that apply multifolded *ptugmata* with a suitable bandage [Leonides].”¹⁷⁷

Cassius Felix is the best representative writing in Latin. He applies *ptugmata* with rose oil, etc. to the abdomen for fever, cold in summer, warm in winter (61.5) and to the back, etc. with warm water (*calida*) and rose oil to promote sleep in cases of phrenitis (62.4). For pleuritis with fever “you will use *ptugmata*; that is, warm rags (*pygmatis id est pannis calidis . . . uteris*, 66.11).”

Spheniskos (σφηνίσκος)

Wedges to keep orifices like the mouth open during surgery are given this name (see under Miscellaneous Parasurgical Items), but it also designates pledgets that are, apparently, wedgelike in form. They are said to be made of twisted rags,¹⁷⁸ sometimes medicated,¹⁷⁹ and are used to: arrest nasal hemorrhage (Paul 2.58.1, 3.24.8), set fractured nose (Paul 6.91.1), and pack surgical wounds created in arteriotomy (Aëtius 7.92.19; Paul 6.4.1) and periscuphismos (Aëtius 7.93.8 & 22; Paul 6.7.1 [Leonides]).

In the operations for arteriotomy and periscuphismos Paul packs the incisions made with either *spheniskoi* or *mota* (σφηνίσκοις ἢ μοτοῖς χωρίσμεν ἀπ’ ἀλλήλων . . .). This more or less equates the two; so it is no surprise when Aëtius, in his account of the former operation indicates that *spheniskos* is basically a class of *motos*: “next we keep the incision open [= we apply *mota* throughout] by inserting *spheniskoi*.”¹⁸⁰

Splen (σπλήν)

A compress or pad, often medicated with wax, wine, or oil, especially when applied to or in conjunction with fractures. *Splen* occurs regularly in this context from the

176 . . . πτύγμα διάβροχον ὀξυκράτῳ ἐπιθεῖς ἐπίδησον καὶ ἕα ἡμέρας γ. καὶ λύσας εὐρήσεις καθαρόν τὸ δῆγμα.

177 ἄνωθεν δὲ πτύγματα πολυπτύχα ἐπιτιθέναι καὶ ἐπιδεσμεῖν προσηκόντως.

178 σφηνίσκος ἐκ ῥάσκους; σφηνίσκους στρεπτοὺς ἐκ ῥάσκους (Paul 2.58.1; 6.4.1; 6.91.1).

179 Paul 2.58.1.

180 7.93.8: εἴτα σφηνίσκους τῇ τομῇ ἐντιθέντες διαμοτοῦμεν. See again Paul 6.4.1: καὶ ξύσαντες τὸ ὁστέον σφηνίσκον ἐκ ῥάσκους ἐμβάλλομεν . . . καὶ τῇ ἐμώτῳ θεραπεύσομεν ἀγῶγῃ.

Hippocratic work *Fractures* through to Paul. A *splen* may be larger, thicker or folded over several times.¹⁸¹ In the latter sense *splen* must be the equivalent of *ptugma* (see above, s.v.). The Latin term must be *pannus*, as Celsus applies it to a folded compress applied before bandaging:

[Then the fractured limb] should be wrapped in rags/cloths (*pannis*) folded two or three times and moistened with wine and oil. It is best if they are linen.¹⁸²

Splenion (σπληνίον; Diminutive σπληνάριον)

LSJ defines *splenion* as a pad or compress of linen. There are indeed passages in which a medicated cloth of linen (*othonion*), termed *splenion*, is applied to an afflicted part, as well as situations where no cloth is mentioned but can be reasonably assumed. Examples include Oribasius, *Syn.* 7.11.15:

Wax softened in the sun in combination with an abundance of copper flakes or copper carbonate heals old ulcers. You need to plaster [the mixture] on linen cloth, apply it, and leave the *splenion* continually in place.¹⁸³

Or again [Hippocrates] *Ulcers* 26P where, if in performing phlebotomy the bleeding does not stop, the author urges us to elevate the hemorrhaging limb and bandage the wound: “next apply a twofold *splenion*, moistened with wine, and above it clean wool with olive oil.”¹⁸⁴

In contrast, Aëtius specifically includes the name *splenion* in two lists of plasters in his fifteenth book,¹⁸⁵ and it appears that many of the numerous references to *splenion*

181 Paul 6.93.3 (και σπλήνας... τοὺς μείζοντας καὶ παχυτέρους παραθήσομεν, φλεγμονῆς μὲν οὐσης, ἐλαιοβραχεῖς, οὐκ οὐσης δὲ ξηροῦς [fracture of clavicle]); 6.99.6 (δεῖ σπλήνας τριπτύχους ἐλαιοβραχεῖς ἐπὶ τοῖς ἐπιδέσμοις περιβάλλειν [fractured arm]); 6.113.1 (διὰ τῶν πολυπτύχων προστυπώσει σπληνῶν ἅμα ταῖς πρεπούσαις ἐπιδέσεσιν [dislocation of clavicle]).

182 8.10.1E: *Tum id involvendum duplicibus triplicibusve pannis et in vino et oleo tinctis, quos linteos esse commodius est.*

183 παλαιὰ δ' ἔλκη ἰάται κηρὸς ἐν ἡλίῳ μαλαχθεῖς καὶ χαλκοῦ λεπίδα πλείστην ἀναλάβων ἢ χρυσοκόλλαν· δεῖ δ' εἰς ὀθόνιον ἐμπλάσσοντα τιθέναι καὶ μὴ ἀφαιρεῖν συνεχῶς τὸ σπληνῖον. Repeated, Oribasius, *Eunap.* 3.25.15.

184 ...ἐπειτα σπληνῖον διπλόον προσθεῖς, τέγξας οἶνω, καὶ ἄνωθεν εἴριον ἐλαιώσας καθαρὸν... (Potter).

185 15.13.292: Τυρία ἀνεπίδετος (a plaster not requiring a bandage; classified under ἔμπλαστροι ἔναιμοι κολλητικαὶ καὶ πολύχρηστοι); 15.14.238: ἡ Κυζικηνή (classified under ἔμπλαστροι κεφαλικάι, καταγματικάι, πολύχρηστοι).

can be understood in the generic sense of ‘plaster’ or ‘salve.’ Take, for example, Aëtius 7.82.8–10 = Hirschberg, Waugh pp. 118–119. Chp. 82:

In cases of *poroi* [stony growths] growing on the exterior of the eyelids, after they have been incised and scooped out, apply a *splenion* of tetrapharmakos.¹⁸⁶

Or again: Philumenus, *Venomous Creatures* 33.6.2:

A *splenion* of juice of allheal applied to the bite also helps . . .¹⁸⁷

Or yet again: Oribasius, *Syn.* 8.34.1:

For Split Lip. Apply the inner membrane of an egg as a *splenion*.¹⁸⁸

Decisive is Oribasius who, among directives for postsurgical treatment of patients suffering from varicose veins, contrasts *splenion* as a plaster with a medicated piece of linen (*Coll. Med.* 45.18.31[Helodorus?]):

To staunch bleeding, we treat those operated on for varicose veins by applying a *splenion* of one of the plasters called ‘hemostatic’, superimposed by a sponge moistened with oxycrate (sour wine and water) pressed down gently with a bandage; or, in place of the plaster (*emplastos*), we first apply under the sponges linen (*othonion*) soaked in oxycrate.¹⁸⁹

Paul (5.8.2) speaks of molding or shaping. For scorpion bites:

Unfired sulfur mixed with turpentine also helps, and likewise juice of allheal flattened in the shape of a *splenion* and applied . . .¹⁹⁰

186 ἐπὶ δὲ τῶν ἔξωθεν τοῖς βλεφάροις ἐπιφυομένων πύρων μετὰ τὸ διελεῖν καὶ ἐκγλύψαι σπληνῖον ἐπιτίθει τῆς τετραφάρμακου. The *tetrapharmakos* was a compound of wax, tallow, pitch and resin: Galen, *Simplex* 12.328K.

187 ὡφελεῖ δὲ καὶ χαλβάνης σπληνῖον ἐπιτεθὲν κατὰ τοῦ δῆγματος . . .

188 πρὸς χεῖλη κατεργαγόντα· ὡς τὸν ἐντὸς ὑμένα ὡς σπληνῖον ἐπιτίθει.

189 ἄγομεν δ’ ἐναίμωσ τοὺς κίρσουληθέντας, ἢ σπληνῖον ἐμπλάστρου τῶν ἐναίμων καλουμένων τινὸς ἐπιβάλλοντες καὶ κατ’ αὐτοῦ σπόγγον ὀξύκράτῳ διάβροχον ἐπιβάλλοντες ἡσυχῇ τε δεσμῶ πιέζοντες, ἢ ἀντὶ τῆς ἐμπλάστρου ὀθόνιον ὀξύκράτῳ βεβρεγμένον προποτιθέντες τοῖς σπόγγοις.

190 βοηθεῖ δὲ καὶ θεῖον ἄπυρον ἀναληφθὲν ῥητίνῃ τερμινθίνῃ, ὁμοίως δὲ καὶ χαλβάνῃ πλατυνθεῖσα σπληνίου τύπον καὶ ἐπιτεθεῖσα . . . (= a summary of Philumenus, *Venomous Creatures* 14.5.2).

Elsewhere there is a reference to a *splenion* that is longish (ὀπόμηκες); otherwise, we find only a few testimonia to size.¹⁹¹ These *splenia* are most likely cloth pads.

Splints

See ss.vv. above; *canalis/solen, ferula/narthex*.

Sponge (σπόγγι, Latin: *spongea*)

Of more than a thousand references to sponges in Greek texts alone, the vast majority occur in medical literature. Clearly sponge was de rigueur in every healer's kit and clinic. Its functions were many. The most obvious involved cleaning or moistening surfaces in preparation of drugs or special foods.¹⁹² And, of course, application of sponges to the surface and orifices of the body or to organs garners frequent mention: e.g., Oribasius, *Ecl. Med.* 101.4 (wiping off scabs after application of collyrium for pustules on head and jaw) and Aetius 5.121.11 (cleansing residue from the mouth in fever). Among more mundane procedures [Dioscorides] speaks of relieving hiccups by pressing a sponge imbued with warm water to the stomach (*Euporista or Simples* 2.5.2). To illustrate more serious interventions we may cite Galen, *Meth. Healing* 10.414K (= J-H 2.162–163), where a moist warm sponge is applied to a distended prolapsed intestine in gastrorrhaphia,¹⁹³ Galen, *Comm. Hipp. Fractures* 18b.568K, where gladiatorial wounds are constantly moistened with a sponge,¹⁹⁴ and Oribasius, *Coll. Med.* 46.19.17, where a sponge is pressed against the meninx to keep it moist and protected during trepanation.¹⁹⁵

We several times find sponges associated with leeching. In a passage reproduced by successors Galen says:

191 Large: Galen, *Cmpds. by Kind* 13.815K (ἐπὶ τῶν ὑπονόμων μεγάλοις δεῖ χρήσθαι τοῖς σπληνίοις); Aetius 9.2.61 (ἐπιθετέον μέγα σπληνίον); longish, small: Aetius 15.18.14 (ἔστω δὲ σμικρόν τὸ σπληνίον, ὀπόμηκες τῷ σχήματι, ἄνωθεν δὲ αὐτοῦ ἐπιτίθει μέγα σπληνίον).

192 Oribasius, *Coll. Med.* 12.sigma.45.11 (moistening *lopada*/shallow vessel in preparing swine and lamb fat: κατὰ χειρὶ εἰς νενοτισμένην σπόγγῳ λοπάδα).

193 σπόγγον οὖν χρή μαλακὸν ὕδατι θερμῷ βρέξαντες, εἴτ' ἐκπιέσαντας ἐκθερμῆναι τούτῳ τὸ ἔντερον; copied by Paul 6.52.1.

194 ... σπόγγους καθεῖς μαλακοὺς, εἴτα δι' ὅλης σχεδὸν ἡμέρας τε καὶ νυκτὸς ἐπιβρέχων; copied by Oribasius, *Coll. Med.* 46.1.121.

195 σκεπέσθω ἡ ἀνάτρησις ἢ σπόγγῳ μαλακῷ ... ἵνα ὑγραίνηται μὲν ἡ μῆνιγξ, μὴ πλῆσσηται δέ.

We have to toss them [leeches] into clear, cold water... Next, when we have wrapped them with sponge and cleaned off their slime, we will apply them manually.¹⁹⁶

To these directives Antyllus adds:

After (the leeches) fall off, if the part admits of a cupping vessel, the poison (heparin) should be drawn out by applying one... If not, foment with sponges.¹⁹⁷

Aside from leeching, fomenting with sponges was common practice for swellings and bruises. A number of references to treating black eyes with them can be traced back to Galen's *Cmpds. by Place*:

Very suitable for black eyes caused by blows are fomentations consistently applied with a soft sponge followed by application of a sponge soaked in vinegar well diluted [with water].¹⁹⁸

Other situations in which we find sponges recommended for fomentation include: various eye conditions,¹⁹⁹ severe sore throat,²⁰⁰ livid spots on the skin of the elderly,²⁰¹ abscesses,²⁰² poisonous bites,²⁰³ dislocated jaw,²⁰⁴ surgery for enterocele,²⁰⁵ severe

196 *Leeches, Revulsion, Cupping, etc.* 11.318K: δεῖ δὲ ἐμβαλεῖν αὐτὰς εἰς ὕδωρ χλιαρὸν καὶ καθαρὸν ἀγγεῖον εὐρύ, ἔπειτα σπόγγῳ περιλαβόντες αὐτάς καὶ τὸ γλοιώδες ἀποκαθάρσαντες διὰ τῶν χειρῶν προσέξομεν. Reproduced by Oribasius, *Coll. Med.* 7.21.4 [Antyllus] & *Syn.* 1.15.2; Aëtius 3.22.6.

197 In Oribasius, *Coll. Med.* 7.21.8: μετὰ δὲ τὸ ἀποπесεῖν, εἰ ὁ τόπος δέχοιτο σικύαν, τὸ ἰώδες διὰ προσθέσεως αὐτῆς ἀφελκυστέον... εἰ δὲ μή, πυριατέον σπόγγοις. In the event a leech was accidentally swallowed, it might be retrieved with a moist sponge let into the fauces: Galen, *Antidotes* 14.143K [Asclepiades].

198 12.797–798K: πρὸς δὲ τὰ γινόμενα περὶ τοὺς ὀφθαλμοὺς οἰδήματα διὰ τὰς πληγὰς λίαν ἀρμόττει πυρία μαλακῇ σπόγγῳ συνεχῶς γινομένη, εἴτα ὅξει βρεχόμενος κεκραμένῳ καλῶς ὁ σπόγγος καὶ ἐπιτιθέμενος. Repeated by Pseudo-Galen, *Drugs Easily Procured* 14.348 & 351K and Oribasius, *Eunap.* 4.19.5.

199 Oribasius, *Syn.* 8.39.4 (ophthalmia); Aëtius 7.35.20 = Hirschberg, Waugh pp. 52–53. Chp. 35 (muokephalon); Aëtius 7.56.9 = Hirschberg, Waugh pp. 90–91. Chp. 56 (atrophy and pthisis); Aëtius 7.84.10 = Hirschberg, Waugh pp. 120–121. Chp. 84 (kritis or posthia).

200 Celsus 4.7.2.

201 Oribasius, *Syn.* 5.24.2.

202 Cassius Felix (18.5); Paul 4.23.1.12.

203 Philumenus, *Venomous Creatures* 15.11.5; Cassius Felix (67.2).

204 Paul 6.112.3.

205 Oribasius, *Syn.* 3.28.11.

constipation,²⁰⁶ difficult menstruation,²⁰⁷ epilepsy²⁰⁸ and as a rubifacient prior to cupping.²⁰⁹ In these cases the sponges were moistened or soaked with liquids: warm water, vinegar, wine, and combinations of sour wine and water called *oxukraton* (Oribasius, *Coll. Med.* 8.6.36) and oil and water (Paul 6.112.3).

Sponges fashioned into appropriate shapes and sizes were imbued with these and other substances and inserted into orifices of the body or into wounds and incisions. Gynecological concerns come first to mind. Here we may cite Soranus, who places a small, medicated oblong sponge as far as possible into the genitalia in cases of uterine hemorrhage, or forceably binds a sponge in the vagina to correct uterine prolapse.²¹⁰ To provoke expulsion of an aborted fetus Aëtius positions dry sponge moistened with opopanax at the cervix (16.20.11–12). Turning to lesions, Oribasius inserts a medicated sponge into a wound/ulcer as a styptic (*Ecl. Med.* 85.3). Again, he positions a soft sponge attached to a linen thread to regulate the draining of pus after opening an empyema (*Coll. Med.* 44.7.8). Celsus applies a bit of sponge imbued with boiled honey as an agglutinant for fistula (5.28.12N). And for nasal hemorrhage Scribonius prescribes plugging nostrils with an aptly shaped piece of sponge treated with vinegar (*Comp.* 46).

Proceeding along similar lines, Galen favors fresh sponge soaked in water or wine for sealing wounds and recounts an instance in which he had seen one of his teachers arrest a surgical hemorrhage with a piece of dry sponge saturated with bitumen and set afire on the incision (*Simples* 12.376K).²¹¹ Galen also allows for pitch in this operation. Elsewhere we hear often sponges fired for their ashes; these were desired as styptics and as medication for a variety of conditions.²¹²

Sponges also played a role in dressings. We may cite as examples Celsus, who seals fistula with a lint plaster topped by a vinegar-soaked sponge (5.28.12H) and excerpts

206 Aëtius 9.41.36.

207 Soranus, *Gyn.* 3.13.2 Ilberg = 3.2.218–219 BGM; Aëtius 16.61.37.

208 Cassius Felix (71.2).

209 Oribasius, *Coll. Med.* 7.16.3 [Antyllus].

210 Soranus, *Gyn.* 3.41.6 & 4.37.2 Ilberg = 3.12.52–57 & 4.6.100–106 BGM respectively.

211 See also Paul 7.3.18.149–151. For bitumen see Scarborough (2011) 18, note 70.

212 Most references to sponge-pitch ashes, often mixed with other material, have to do with arresting bleeding. See, e.g.: [Dioscorides], *Euporista or Simples* 1.199.2, Galen *Theriac to Piso* 14.289K, Oribasius, *Coll. Med.* 10.22.2 and Paul 3.26.17.2 & 4.53.5.13 (general); Oribasius, *Ecl. Med.* 86.3 & Aëtius 6.93.7 (applied for nosebleed); Oribasius, *Ecl. Med.* 147.6 & *Syn.* 9.42.6, Aëtius 16.62.28, Paul 3.62.1.16 (both drunk and applied locally for excessive menstrual flow); Oribasius, *Ecl. Med.* 63.6 & Aëtius 11.27.24 [Rufus] (applied locally or injected for bladder hemorrhage); Paul 6.79.1 (mixed in plaster for hemorrhoids); Oribasius, *Ecl. Med.* 54.5.9 (injected for dysentery). There are also references to the ashes of sponges soaked in bulls blood used as an astringent/hemostat, e.g. Aëtius 8.23.15.

from Oribasius where swellings and a fistulaous ulcer are covered with medicated sponges kept in place with a bandage (*epidesis*).²¹³

Sponges even served to position and protect patients, as when Soranus deploys them around the abdomen and hips in administering uterine massage in a bath (*Gyn.* 3.14.2 Ilberg = 3.2.235–236 BGM), or as when Herodotus protects delicate areas of obese patients in an oil bath (Oribasius *Coll. Med.* 10.37.7). Aëtius uses a sponge to shield the eyes of a patient when cauterizing fistula lachrymalis (7.88.5 = Hirschberg, Waugh pp. 126–127. Chp. 88).

To execute these different procedures, the size, quality, and shape of the sponge involved differed accordingly. Erasistratus applies boad, thick, hollow, sponges for heat stroke (Aëtius 6.41.14 [Galen]) and Cassius Felix (42.15) broad, coarse, hollow types for stomach disorder. Soranus advocates flat, soft sponges for supporting the patient under massage referred to immediately above. Softness, in fact, often seems a desideratum.²¹⁴ Dry, firm and coarse sponges are also mentioned often enough.²¹⁵ According to Oribasius dry, coarse sponges were classed as masculine and soft sponges as feminine. Those called ‘goats’ were regarded as being the coarsest of all.²¹⁶ There are many references to the desirability of fresh/new sponges; Galen in several passages is quite insistent upon it.²¹⁷ When these were not available old sponges could be used if cleaned with sodium carbonate and lye.²¹⁸ New sponges were those freshly taken from and still preserving the smell of the sea.²¹⁹

213 *Coll. Med.* 44.12.10 [Galen] and *Syn.* 7.35.2 (repeated *Eunap.* 3.51.2).

214 μαλακός (Soranus, *Gyn.* 3.14.2 Ilberg = 3.2.236 BGM), τρυφερός (Soranus, *Gyn.* 2.7.2 Ilberg = 2.3.9 BGM), άπαλός (Aëtius 7.35.20 = Hirschberg, Waugh pp. 52–53. Chp. 35), εύαφής (Oribasius, *Ecl. Med.* 103.3). For άραιός (= loose texture) see [Dioscorides], *Euporista or Simples* 1.199.2. Perhaps Alexander of Tralles is referring to an especially soft sponge when he bathes aegilops with an “ophthalmic sponge” (μετά σπόγγου όφθαλμικού) soaked in honey water (*Therap.* 2.69.21).

215 For έσκελετευμένοι σπόγγοι see Aëtius 16.20.11–12 (expelling a fetus) & 16.107.16 (phimosis of uterus). In the former situation a tent of papyrus also can be used.

216 Oribasius, *Coll. Med.* 13.sigma.3: <σπόγγους> τοὺς μὲν άρρενας έκάλεσάν τινες, λεπτοτρήτους καί πυκνοὺς όντας, ών τοὺς σκληροτέρους τράγους ώνόμασαν· τοὺς δὲ θήλεις όσοι έναντίως τοῖς προειρημένοις διάκεινται.

217 *Meth. Healing* 10.954K = J-H 3.436–437 (edema): καινός δ’ έστω πάντως [ό σπόγγος] εί μέλλοι τι χρηστόν έργάσασθαι; *Glaucon, Meth. Healing* 11.102K (a porous swelling or tumor): εἶναι δε χρή τόν σπόγγον πάντως καινόν. Perhaps ‘white’ = new at Aëtius 2.224.13.

218 Oribasius, *Coll. Med.* 44.28.3; *Syn.* 7.35.3.

219 Paul 7.3.18.148: σπόγγος ό μὲν καινός έτι διασώζων τήν τής θαλάσσης όσμην...; copied from Galen, *Simples* 12.376–377K. See also Paul 2.48.1 and Oribasius, *Ecl. Med.* 46.2.

Finally, sponges were thought to impart to stones found in them the capacity to dissolve and purge bladder and kidney stone when ground to powder and taken with wine. This byproduct of sponges is mentioned numerous times.²²⁰

For *penicillum* as sponge, see above, s.v.

Truss for hernia

We hear of such here and there. Celsus speaks of a ball of rags (*fascia*) enclosed in a band for a prolapsed intestine in the case of a child.²²¹ Oribasius (*Coll. Med.* 48.57) describes a truss made up of bands (*telamones*) for inguinal hernia; this he calls a *boubonophulax*. *Telemon* again occurs in the sense of a support in the later stages of pregnancy in Soranus (*Gyn.* 1.56.4 Ilberg = 1.18.62–63 BGM).

Wool

Along with linen and sponge, carded wool and woolen cloth (ἔριον/*erion* in Greek, *lana* in Latin) were basic to the day-to-day work of a surgeon. We find wool utilized in many of the same procedure as linen and sponge, including cleansing, application of medication and fomentation. Likewise, wool was often fashioned into plugs, suppositories and dressings, where it occurs alone, or in combination with linen and sponge, or is mentioned as alternatives to them. Celsus illustrates this nicely when he dresses the incision to access inguinal hernia with lint (*linamenta*) covered with greasy (lanolin coated) wool, or with sponge soaked in vinegar (7.19.5 & 9). Oribasius details a complex dressing applied after trephining/trepanning the skull. Its main features consist of a linen pad/compress surmounted by a ring of wool encircling the perforated area. This ring is called *kouphister* or ‘lightener’ because it supports another layer of wool covering the entire head. Over this arrangement is placed a hairnet cut down the middle with scissors (ψαλίδι) to create a cavity. The cavity is then bounded on its edges/extremities by soft wool folded double, through which rose oil can be instilled. This last application of wool is called *epistaktes*, because it allows for the instillation of the

220 Oribasius, *Coll. Med.* 13.lambd. 22, *Syn.* 9.24.7, *Eunap.* 2.1.lambd.16 & 4.100.7; Aëtius 3.152.9, 11.13.74 & 78. Galen, *Simples* 12.205–206K (copied by Aëtius 2.27.1); so too Paul 3.45.2.22 & 7.3.11.112.

221 *Fascia* . . . cui imo loco pila adsuta est ex panniculis facta . . . (7.20.1).

oil (*Coll. Med.* 46.19.10–13). In addition to a ring, wool might be shaped flat, and as a sphere or finger.²²²

Wool used medically differs from linen and sponge in a number of ways. One distinction is that unwashed, that is greasy, tufts of wool were often preferred to the clean type, the former being designated by various modifiers: *πιναρόν* (*pinaron*), *ρύπαρόν* (*rhuparon*) and especially *οἰσπηρόν* (*oisuperon*), or *lana sucida*, as it was called in Latin.²²³ Celsus remarks on its strong, offensive smell in treating lethargy (3.20.1). The grease (lanolin) from Attic *oisuperon* was preferred and apparently marketed separately.²²⁴ A second distinction setting wool apart is that, owing to its prehensile nature, a tuft of it was frequently wound around the *puren* (or at least the upper shaft) of a probe when that instrument was brought into play for cleansing, medicating (sometimes by instillation) and fomenting.²²⁵ The same combination of probe and wool was deployed to instill cooling water on the drills used in skull surgery (Oribasius, *Coll. Med.* 46.11.11). As with linen and sponge, the medications commonly mentioned in conjunction with wool are olive oil, wine, eggwhite, roseoil and vinegar.²²⁶ As linen, sponge, and papyrus, the ashes of burnt wool were used as medication.²²⁷

-
- 222 See Paul 3.14.2.30 for placement of flat wool (ἔριον πλατύ) over abdomen for melancholy and Oribasius, *Ecl. Med.* 147.11 for a medicated *pessos* of carded wool shaped like a sphere (σφαίρωθέν) or a finger (εἰς δακτύλου σχῆμα) to arrest excessive menstruation.
- 223 Veterinary treatises lean to *pinaron*; e.g. *Hippiat. Ber.* 117.7.6, *Hippiat. Cantabrig.* 6.3. That these terms meant the same thing is shown by Galen: *Meth. Healing* 10.965K = J-H 3.454–455 (βρέχων ἔριον ἄπλυτον, ὃ καλοῦσιν οἰσπηρόν) and *Hippocratic Glossary* 19.125K (οἰσπιίδας: προβάτου ῥύπον, ἡγρουν ἔριον ῥύπαρόν). See also Galen, *Glaucon*, *Meth. Healing* 11.82K.
- 224 Galen, *Meth. Healing* 10.965K = J-H 3.454–455 (ὅτι δ' ἀμείνων ὁ Ἀττικὸς οἶσπος ἅπαντος ἄλλου... γινώσκεις).
- 225 The probes specified are *mele* (Aëtius 6.91.73), *melotis/melotris* (Dioscorides, *Mat. Med.* 1.105.5; Aëtius 6.81.16) and *hupaleiptron* (Galen, *Meth. of Healing* 10.404K = J-H 2.146). Celsus as usual is not specific, using only the general term *specillum* (6.7.9A); in Scribonius Largus we find *auriscalpium* (230). For instillation with probe for earache, see Galen, *Cmpds. by Place* 12.617K [Apollonius] and *Comm. Hipp. Epidem.* 6, 17b.266K = Wenckebach p. 282. If Rose's text (followed by Fraisse) is right, Cassius Felix twice wipes off an area with a probe wound with *licinium*, which apparently means a tuft of wool (32.12 & 36.4: *leptospathio ferramento licinio involuto*).
- 226 Sulfur also is a popular addition when the application is to jaw, chest, and abdomen: Celsus 4.12.4 (stomach inflammation) & 4.13.3 (pleurisy); Scribonius Largus, *Comp.* 43 (infected parotid gland); Pseudo-Galen, *Drugs Easily Procured* 14.485–486K (excess moisture in female parts); Oribasius, *Ecl. Med.* 34.1 (pleurisy); Aëtius 8.76.25 (pleurisy).
- 227 Galen, *Cmpds. by Kind* 13.904K [Asclepiades]; Oribasius, *Coll. Med.* 14.62.1, line 33. For veterinary references see *Hippiatrica Paris.* 375.1 (cataract) & 446.2 (nosebleed).

Other than being greasy or clean, the surgical sources also describe wool that is soft, fine, and shredded or shaved.²²⁸ Clearly the latter modifier refers to tufts of carded wool; the former two might cover both cloth and tufts. Greasy wool will clearly be tufts; otherwise, the distinction to be made, when that is possible, must be by context.

As in the case of linen and sponge, plugs/suppositories may not only be made of wool but may simply be called *erion*. This is especially true when wool is used to form a *pessos*. In a passage under the rubric “Dealing with the Private Parts of a Woman when excessively Moist in Intercourse” Pseudo-Galen recommends:

Moisten sulphurated soft wool in the infusion [oak gall and water] and without wringing it out let it dry. Make a *pessos* of the wool and give it [to her] to be inserted and she will be like a virgin in intercourse. Let her take up and dry the wool and use it again if she wants.²²⁹

In addition to themselves conveying medications, we hear of unmedicated woolen plugs and bandages positioned in orifices to keep medications in place, specifically those infused into ear and anus.²³⁰ Paul also records the curious view that catheterization can be facilitated by placing such a plug at the distal end of a catheter to create a vacuum when withdrawn by a linen thread.²³¹

The following is a representative list of applications for wool in procedures performed head to foot.

228 Clean, soft: *lana munda ac mollis* (Cassius Felix 59.2, to chest for non remittent fever), καθαρόν και ἀπαλόν (Aetius 4.12.4, to absorb moisture in ear), τρυφερόν (Soranus, *Gyn.* 3.41.5 Ilberg = 3.12.47 BGM, plug to arrest uterine hemorrhage), μαλακόν (Paul 3.12.34, to medicate synchysis of eye); fine and soft: λεπτόν και μαλακόν (Oribasius, *Coll. Med.* 46.19.5, for a dressing after drilling on skull); shredded/carded: διεξασμένον (Oribasius, *Ecl. Med.* 147.11, for a *pessos*). Rarely, color is a consideration: Dioscorides, *Mat. Med.* 5.87.10 (white in preparation of litharge); Aëtius 9.34.111 (purple applied to stomach for problems caused by dryness).

229 *Drugs Easily Procured* 14.485–486K: εἴτα βρέχε ἔριον τεθυωμένον (= τεθειωμένον: cf. Paul 3.33.2) τρυφερόν τῷ ἀποβρέγματι και μὴ ἐκπιέζων ἕα ξηρανθῆναι και πεσσόν ποιῶν τοῦ ἐρίου διδου ὑποτίθεσθαι. και ἔσται ὡς πάρθενος ἐν τῇ συνουσια. αἰρείτω τὸ ἔριον και ξηραίνετω και πάλιν χρῆσθω εἰ θέλει. The excess of moisture is undesirable because it prevents pregnancy; so the heading of Aëtius 16.66.1–4 [Aspasia] where this passage is restated.

230 Pseudo-Galen, *Drugs Easily Procured* 14.317 (infuse olive oil in ears and plug for headache); Oribasius, *Eunap.* 4.41 (plug ear after injection of nitron and vinegar to remove dirt/wax); Oribasius, *Ecl. Med.* 82.1 (bandage plaster in place after injection by *puoullkos* to combat rectal inflammation).

231 Paul calls the process *euodiasmos* (6.59.1). See Milne (1907) 144 for a critique.

Head: Wool saturated with roseoil and applied for headache (Galen, *Cmpds. by Place* 12.502K [Apollonius]); saturated with eggwhite as a postsurgical compress (*ptugma*) forming a dressing with a *motophulax* and bandage for a hydrocephalic child (Aëtius 6.1.45 & 15.12.39 [Leonides]).

Eye: The seventh book of Aetius' compendium lists a host of eye complaints involving various woolen plasters, medicated compresses, dressings, and bandages: bandage for edema (16.13 = Hirschberg, Waugh pp. 22–23. Chp. 16), plaster of wool soaked in wine rose oil and egg covered with wool for hyposphagma or suffusion of blood in eye (22.8 = Hirschberg, Waugh pp. 28–29. Chp. 22), wool plaster with egg, rose oil and wine for deep trauma (24.9 = Hirschberg, Waugh pp. 30–31. Chp. 24), application of wool with egg, rose oil, and wine for proptosis (26.11 = Hirschberg, Waugh pp. 32–33. Chp. 26), compress (*pugmation*) with egg, rose oil, and wine on soft wool, after surgery for staphyloma (37.34 = Hirschberg, Waugh pp. 56–57. Chp. 37), wool anointed with honey and saffron under a compress (*ptugma*) for ekpiesmos/exophthalmos (57.12 = Hirschberg, Waugh pp. 90–91. Chp. 57), application of egg, rose oil, and wine on soft wool for synchysis (58.7 = Hirschberg, Waugh pp. 90–91. Chp. 58), dressing of eggwhite, after surgery, for pterygium (62.23 = Hirschberg, Waugh pp. 96–97. Chp. 62), application of wool moistened with eggwhite after plastic operation (71.50 = Hirschberg, Waugh pp. 106–107. Chp. 71 [Leonides]), application of wool moistened with eggwhite after incision of abscess (81.4 = Hirschberg, Waugh pp. 118–119. Chp. 81 [Demosthenes]).

Ear: Fomentation of inflamed ear with wool wrapped probe (Aëtius 6.81.16), removal of foreign objects with wool wrapped probe (Celsus 6.7.9A; Aëtius 6.87.2).

Nose: Hemostat for nosebleed requiring wool wrapped probe (Galen, *Cmpds. by Place* 12.691K [Heracleides]); hemostat for nosebleed requiring medicated wool twisted like lampwick (Galen, *Cmpds. by Kind* 13.858K [Heracleides]); medication of ozaina, or fetid polyp, with wool wrapped probe (Celsus 6.8.1B; Aetius 6.91.73).

Mouth: Ulceration anointed with wool wrapped probe in cases involving a child (Celsus 6.15.3), application of copper sulfate (*chalkanthon*) and olive oil for loose teeth (Pseudo-Galen, *Drugs Easily Procured*, 14.358K); hot olive oil applied with probe wrapped in wool for toothache (Scribonius Largus, *Comp.* 56); application of medicament with wool wrapped probe to remove superfluous section of uvula (Scribonius Largus, *Comp.* 230).

Neck, Throat: Medicated wool with butter applied for inflammation of parotid gland (Galen, *Cmpds. by Place* 12.669K [Archigenes]); fomentation of neck for inflamed tonsils with soft wool suffused with olive oil (Aëtius 8.48.30); fomentation of neck with wool suffused with hot oil for bone/thorn in fauces (Aëtius 8.53.20); as a dressing with *motophulax* after surgical removal of choiras (Aëtius 15.5.76 [Leonides]).

Arm, Shoulder: Wool fashioned in a ball and placed in armpit to keep displaced humerus properly reduced and effectively bandaged (Celsus 8.15.7).

Chest: Wool soaked in wine and oil covering the entire chest after incision of intercostal abscess (Oribasius, *Coll. Med.* 44.7.9–10); soaked with wine and oil as one element of post surgical dressing after excision of rib (Oribasius, *Coll. Med.* 44.8.11); soaked with oil of rue or sulfur for pleuritis (Celsus 4.13.3; Oribasius, *Ecl. Med.* 34.1 = Aëtius 8.76.25).

Abdomen: Greasy wool with vinegar and rose oil over lower abdomen after abortion of fetus by embryo hook (Celsus 7.29.10); bandaging the entire body from armpit to groin with soft woolen cloth suffused with warm olive oil in treating an abdominal wound (Galen, *Meth. Healing* 10.419 = J-H 2.174–175, followed by Paul 6.52.5); clean wool soaked in sweet warm olive oil placed over the belly for dysuria and bladder issues (Aëtius 5.129.8–9 [Philumenus]); fomenting ileus with wool soaked in olive oil and other ingredients (Aëtius 9.28.59–62 [Archigenes]); purple wool applied to the stomach for belly trouble (Aëtius 9.34.111–112 [Galen]).

Groin; Private Parts: Soft wool suffused with warm olive oil over pubes, hips and groin after surgery for bladder stone (Celsus 7.26.5C); application of wool suffused with warm olive oil to swollen groin (Oribasius, *Syn.* 7.31.1; *Eunap.* 3.46.1); exterior application of greasy wool for uterine tear and pus (Aëtius 16.88.39); application to inflamed scrotum/testicles of a complex plaster taken up on a rag and covered with oiled wool (Paul 3.54.2); placement in the vagina of a woolen plug (*sustremma*) wrapped in thin linen to secure proper position of prolapsed uterus (Paul 3.72.2–3).

Rectum: As a medicated suppository for hemorrhoids (Galen, *Cmpds. by Place* 13.314K [Asclepiades]); a suppository like a *pessos* for relief of bladder infection (Rufus of Ephesus, *Dis. of Kidney and Bladder* 7.5.2–3).

Feet: Greasy wool with rose oil and wine for gout (Scribonius Largus, *Comp.* 158 & 161).

For woolen thread for suturing, see Eyed Needles, under Needles.

Postscript

It is now 40 or more years since I became interested in the surgeons of the Greco-Roman world. At the time I was teaching a course on Greco-Roman private life and thought I should offer a lecture on medicine. Like every student of the Classics, I was reasonably well acquainted with the history, literature and art produced by the ancients; I fancy I even knew something of their medical theories, in particular those intersecting with philosophy. But I had little or no sense of the nitty gritty of medical practice, specifically surgery. That led me to Milne's book, which led in turn to texts ranging from the Hippocratics to the early Byzantines who digested the work of earlier practitioners. To my astonishment I learned that well over a hundred interventions were being performed over the course of the Roman Empire. Moreover, I learned that many of the tools used in this period had been recovered and were preserved. Access to these tools fired my interest and thus began my preoccupation with this class of minor objects.

Texts, copied and recopied and surviving in versions far removed from the lifetimes of those who produced them do not have the immediate effect of an object actually used. Those who have had the privilege of taking into their hands an ancient scalpel, retractor or forceps, let alone something as intricate as a speculum, have perhaps shared with me the excitement I experienced upon being allowed to handle the marvelous tools preserved in the Johns Hopkins, British, Mainz and Naples Museums. At such moments, I vividly realized that similar spoon/spatula probes and containers for medication must have been deployed by Antonius Musa as he ministered to the Emperor Augustus, that the knives and retractors before me were the types used by the anonymous surgeon who treated the varicose veins of Gaius Marius; or, again, that the cauteries, drills, saws and chisels I had before me were the very models in possession of famous practitioners like Antyllus, Heliodorus and Leonides. Though it may be uncertain how successful these doctor surgeons always were in bringing relief to the suffering, we cannot help but be impressed by their attempts to do so. While, therefore, this book is an effort to pull together as complete a picture as one currently can of the surgical instruments and paraphernalia developed and available in Greek and Roman Times, it is, of its very nature, a tribute to the enterprising spirit of those who wrote about and actually wielded the instrument types that are the focus of this study.

Bibliography

- Adoga, Nimkur (2011): Adeyi A. Adoga, Tonga L. Nimkur, "The Traditionally Amputated Uvula amongst Nigerians: Still an Ongoing Practice," *ISRN Otolaryngology* (Published online Nov. 22, 2011. Free PMC Article).
- Aleshire (1989): Sara B. Aleshire, *The Athenian Asklepieion, The People, their Dedications and the Inventories* (Amsterdam: J.C. Gieben).
- Allason-Jones (1989): L. Allason-Jones, *Women in Roman Britain* (London: British Museum Publications).
- Amundsen (1973): D.W. Amundsen, "The Liability of the Physician in Roman Law," in H. Karplus (ed.), *International Symposium on Society, Medicine and Law* (Amsterdam, New York and London: Elsevier), 17–30.
- Andorlini (2012): Isabella Andorlini, "Gli strumenti perduti di Galeno," *La Torre di Babele*, 8: 239–247.
- André (1987): Jacques André, *Être Médecin à Rome* (Paris: Société d'Édition Les Belles Lettres).
- Bachmann, Czyz (1977): H.-G. Bachmann, W. Czyz, "Das Grab eines römischen Malers aus Nida-Hedderheim," *Germania*, 55: 85–107.
- Baker (2004): Patricia A. Baker, "Roman Medical Instruments: Archaeological Interpretations of their Possible Non-functional Uses," *Social History of Medicine*, 17.1: 3–22.
- (2013): Patricia A. Baker, *The Archaeology of Medicine in the Greco-Roman World* (Cambridge: Cambridge U. Press).
- Bayardi (1775): Ottavio Antonio Bayardi, *Catalogo degli antichi monumenti dissotterati della scoperta città di Ercolaneo* (Naples: Regia Stamperia).
- Baykan (2012): Daniş Baykan, *Allianoi Tıp Aletleri = Studia ad Orientem Antiquum*, 2 (Istanbul: Institutum Turcicum Scientiae Antiquitatis, Türk Eskiçağ Bilimleri Enstitüsü [Turkish with a summary in English pp. 161–168]).
- Beckby (1957–58): H. Beckby (ed.), *Anthologia Graeca*, 4 vols., 2nd edition (Munich: Heimeran).
- Benedum: (1978): J. Benedum, "Der sogenannte Frenulumspanner," *Medizinhistorisches Journal*, 13: 120–123.
- Bennion (1979): E. Bennion, *Antique Medical Instruments* (London: Sotheby Parke Bernet; Berkley [Calif.]: University of California Press).
- Berger (1970): E. Berger, *Das Basler Arztrelief: Studien zum griechischen Grab und Votivrelief um 500 v. Chr. und zur vorhippokratischen Medizin* (Mainz, Philip von Zabern).
- Bliquez (1981a): Lawrence J. Bliquez, "Greek and Roman Medicine," *Archaeology*, 34: 10–17.

- (1981b): Lawrence J. Bliquez, "An Unidentified Roman Surgical Instrument in Bingen," *Journal Hist. of Medicine and Allied Sciences*, 36: 219–220.
- (1982): Lawrence J. Bliquez, "Roman Surgical Instruments in the Johns Hopkins University Institute of the History of Medicine," *Bull. Hist. Med.*, 56: 195–207.
- (1984): Lawrence J. Bliquez, "Two Lists of Greek Surgical Instruments and the State of Surgery in Byzantine Times," *Dumbarton Oaks Papers*, 38: 187–204.
- (1985): Lawrence J. Bliquez, "ΑΙΘΟΥΛΑΚΟΣ, ΚΙΡΣΟΥΛΑΚΟΣ," *American Journal of Philology*, 106: 119–121.
- (1986): Lawrence J. Bliquez, "The Getty Instrumentarium, A revised Opinion," *Getty Museum Journal*, 14: 79–80.
- (1988): Lawrence J. Bliquez, *Roman Surgical Instruments and Minor Objects in the University of Mississippi = Studies in Mediterranean Archaeology and Literature*, Pocketbook 58 (Göteborg: Paul Aströms Förlag).
- (1992): Lawrence J. Bliquez, "The Hercules Motif on Greco-Roman Surgical Tools," in Antje Krug, ed., *From Epidaurus to Salerno, Symposium held at the European University Centre for Cultural Heritage, Ravello, April, 1990 = PACT, Journal of the Centro Universitario Europeo per i Beni Culturali* 34: 35–51.
- (1995): Lawrence J. Bliquez, "Gynecology in Pompeii," in Ph. J. van der Eijk, H.F.J. Horstmannshoff, P.H. Schrijvers, eds., *Ancient Medicine in its Socio-Cultural Context = Clio Medica*, vol. 27 (Amsterdam-Atlanta, Ga., Rhodopi), vol. 1, 209–225.
- (1998a): Lawrence J. Bliquez, "Two 'Sets' of Roman Surgical Tools from the Holy Land," *Saalburg Jahrbuch*, 49: 83–92.
- (1999): Lawrence J. Bliquez, "The Surgical Instrumentarium of Leon Iatrosophistes," *Medicina nei Secoli*, 11 (2): 291–322.
- (2003): Lawrence J. Bliquez, "Roman surgical spoon probes and their ancient names (*mele*, *melotis/melotris*, *specillum*)," *Journal of Roman Archaeology*, 16: 322–330.
- Bliquez, Jackson (1994): Lawrence J. Bliquez, *Roman Surgical Instruments and Minor Objects in the National Archaeological Museum of Naples, with a Catalogue of the Surgical Instruments in the Antiquarium at Pompeii by Ralph Jackson* (Mainz, Philip von Zabern).
- Bliquez, Munro (2007): Lawrence J. Bliquez, Emily J. Munro, "Paulakion and Securicella: Two Hitherto Unidentified Greco-Roman Veterinary Instruments," *Mnemosyne* 60: 490–494.
- Bliquez, Oleson (1994): Lawrence J. Bliquez, John Peter Oleson, "The Origins, Early History, and Applications of the *Pyoulkos* (Syringe)," in Gilbert Argoud, ed., *Science et Vie Intellectuelle à Alexandrie (I^{er}–III^e siècle après J.-C.)*, (Université de St. Étienne, St. Étienne): 83–119.
- Bliquez, Rodgers (1998b): Lawrence J. Bliquez, Priscilla Rodgers, "Kyathos at Aristophanes, *Pax*, 538–542; *Lysistrata*, 443–444 and [Aristotle] *Problems*, 890b7–38," *Classical Philology*, 93: 236–241.

- Boardman (1975): John Boardman, *Athenian Red Figure Vases, The Archaic Period* (London: Thames and Hudson; rep. Toledo, Artes Graficas 1983).
- Boudon-Millot (2007): Véronique Boudon-Millot, "Un traité perdu de Galien miraculeusement retrouvé, *le Sur l'inutilité de se changriner*: texte grec et traduction française," in V. Boudon-Millot, A. Guardasole, C. Magdelaine, eds., *La science médicale antique: Nouveaux regards. Études réunies en l'honneur de Jacques Jouanna*, (Paris: Beauchesne) 73–124.
- Bouzakis, Pantermalis (2008): K.-D. Bouzakis, D. Pantermalis and 8 others, "Design and Manufacturing Aspects of a Vaginal Speculum of Antiquity, as Investigated by Computer Tomographies," *Journal of Archaeological Science* 35: 633–642.
- Breitwieser (2003): R. Breitwieser, "Celtic Trepanation in Austria," in *Trepanation: History, Discovery, Theory*, R. Arnott, S. Finger, and C.U.M. Smith eds., (Lisse, The Netherlands: Swets & Zeitlinger), 147–153.
- Brongers (1969): J.A. Brongers, "Ancient Old-World Trepanning Instruments," *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek*, 19: 7–15.
- Brunner (1893): Conrad Brunner, *Die Spuren der römischen Ärzte auf dem Boden der Schweiz* (Zürich: Albert Müller).
- Buchet, Pilet: (1984): L. Buchet, C. Pilet, "A propos de quelques exemples de pratiques médicales et chirurgicales en Basse-Normandie pendant le Moyen Age," *Archéologie Médiévale*, 14: 61–76.
- Buchheim (1916): E. Buchheim, *Die geburtshilflichen Operationen und zugehörigen Instrumente des klassischen Altertums*. Jenaer medizin-hist. Beitr. 9 (Jena).
- Caton (1914): Richard Caton, "Notes on a Group of Medical and Surgical Instruments found near Kolophon," *Journal of Hellenic Studies*, 34: 114–118.
- Cavenaile (2001): Robert Cavenaile, "L'anesthésie chirurgicale dans l'antiquité Gréco-Romaine," *Medicina nei Secoli*, n.s. 13.1: 25–46.
- Como (1925): J. Como, "Das Grab eines römischen Arztes in Bingen," *Germania*, 9: 152–162.
- Conticello (1990): Baldassare Conticello, et alii, *Riscoprire Pompei/Rediscovering Pompeii, Exhibition by IBM Italia, New York City, IBM Gallery of Science and Art, 12 July–15 September, 1990* (Rome: "L'Erma" di Bretschneider).
- Cruse (2004): Audrey Cruse, *Roman Medicine* (Stroud, Gloucestershire: Tempus).
- Cüppers (1983): H. Cüppers et alii., *Die Römer an Mosel und Saar. Zeugnisse der Römerzeit in Lothringen, in Luxemburg, im Raum Trier und im Saarland. Ausstellungskatalog* (Mainz am Rhein: Philipp von Zabern).
- Dasen (2011): Véronique Dasen, ed., "La médecine à l'époque romaine," *L'Archéothéma* 16, Sept–Oct 2011: 14–15.
- Davidson (1952): G. Davidson, *Corinth, vol. XII, The Minor Objects* (Princeton: American School of Classical Studies at Athens).
- De Carolis (1993): E. De Carolis, "Una cassetta con strumenti chirurgici da Ercolano," in L. Capasso, ed., *Le Origini della Chirurgia Italiana, Temi e Problemi* (Rome: Ministro

- per i Beni Culturali e Ambientali, Servizio Tecnico per le Ricerche Antropologiche e Paleopatologiche, 1933).
- De Carolis (2007): S. De Carolis, "Un nuovo strumento dalla domus Riminese 'del chirurgo,'" *Rivista Storica dell' Antichità*, 37: 119–22.
- (2009): S. De Carolis, "Un nuovo strumento dalla domus Riminese 'del chirurgo': il cucchiaino di Diocle," in L. Braccisi, C. Ravara Montebelli, eds., *Ariminum, storia e archeologia*, 2: *Atti della Giornata di Studio su Ariminum, Un laboratorio archeologico*: vol. 2: 43–47.
- Della Corte (1965): M. Della Corte, *Case ed Abitanti di Pompei*, 3rd ed. curata da Pietro Soprano (Naples: Faustino Fiorentino).
- Deneffe (1893): V. Deneffe, *Étude sur la trousse d'un chirurgien gallo-romain du III^e siècle* (Anvers: H. Caals).
- (1896): V. Deneffe, *Les oculistes gallo-romains au III^e siècle* (Anvers: H. Caals).
- (1902): V. Deneffe, *Le speculum de la matrice à travers les âges* (Anvers: H. Caals).
- Deonna (1938): W. Deonna, *Exploration archéologique de Délos, XVIII, Le mobilier délien* (Paris: Fontemoing et Cie, éditeurs).
- Döderlein (1977): G. Döderlein, *Antike Arzteinstrumente aus ihrer Geschichte* (Tuttligen: Aesulap-Werke AG).
- Dude (2005): Leonardo Dude, "Extraktionszangen der römischen Kaiserzeit," *Saalburg-Jahrbuch* 55 (appeared 2009): 5–131 (92 figg.).
- Dugas (1921): Ch. Dugas, "Le sanctuaire d'Aléa Athéna a Tégée avant le IV^e siècle," *Bull. de Correspondance Hellénique* 45: 335–435.
- Engelman, Knibbe, Merkelbach (1980): *Inscriptionen griechischer Städte aus Kleinasien*, Band 14: *Die Inscriptionen von Ephesos*, Teil IV, Hrsg. Helmut Engelman, Dieter Knibbe, Reinhold Merkelbach (R. Habelt: Bonn).
- Eschebach (1984): Hans Eschebach, *Die Arzthäuser in Pompeii* (Feldmeilen, Switzerland: Raggi-Verlag). Sondernummer *Antike Welt*, 15 Jahrgang 1984.
- Fasbender (1906): Heinrich Fasbender, *Geschichte der Geburtshilfe* (Jena, Fischer: 1906).
- Fasold (1998): P. Fasold et alii, *Ausgrabungen im deutschen Pompeji: Archäologische Forschung in der Frankfurter Nordweststadt* (Museum für Vor- und Frühgeschichte, Frankfurt am Main).
- Feugère (1985): M. Feugère, "Un instrument chirurgical d' époque romaine à Quarante (Hérault)," *Archéologie en Languedoc*, 2: 44.
- Feugère, Künzl, Weisser (1985): Michele Feugère, Ernst Künzl, Ursula Weisser, *Les aiguilles à cataracte de Montbellet* (Saône-et-Loire), *Contribution à l'étude de l'ophtalmologie antique et islamique. Die Starnadeln von Montbellet* (Saône-et-Loire), *Ein Beitrag zur antiken und islamischen Augenheilkunde = Jahrbuch des Römisch-Germanischen Zentralmuseums* 32. A completely french edition under the french title appeared in 1988 (Buguet-Comptour: Mâcon).

- Fischer (1992): K.-D. Fischer, "Die Listen medizinischer Gerätschaften im *Onomastikon* des Pollux und in den *Hermeneumata Monacensia*," in Antje Krug, ed., *From Epidauros to Salerno, Symposium held at the European University Centre for the Cultural Heritage, Ravello, April, 1990* = *PACT, Journal of the Centro Universitario Europeo per i Beni Culturali*, 34: 139–146.
- (1997): Klaus-Dietrich Fischer, "Was ist das δελτάριον in POxy LIX 4001," in Isabella Andorlini, ed., *Specimena' per il Corpus dei Papiri Greci di Medicina, Atti al Incontro di studio, Firenze, 28–29 marzo 1996* (Istituto Papirologico: G. Vitelli, Firenze), 109–113.
- (2012): Klaus-Dietrich Fischer, *De medicina verborum traditorum in scriptis medicis post annum fere millesimum adhibita*, *Technai* 3: 45–54.
- Foster, Kanada, Michaelides (1988): G.V. Foster, K. Kanda, D. Michaelides, "A Roman Surgeon's Tomb from Nea Paphos," *Report of the Department of Antiquities Cyprus*, Part 2 (Nicosia: Dept. of Antiquities, Cyprus), 229–234 with Pl. LXX–LXXI.
- Franzius (1993): Georgia Franzius, "Die römischen Funde aus Kalkriese," in Wolfgang Schlüter, ed., *Kalkriese—Römer im Osnabrücker Land: Archäologische Forschungen zur Varusschlacht*, (Rasch Verlag: Bramsche), 107–199.
- Fuentes Dominguez (1987): Angel, Fuentes Dominguez "Instrumentos Romanos de Medicina en el Museo de Cuenca." *Archivo Espanol de Arqueologia*, 60: 251–274.
- Gager (1992): John G. Gager, ed., *Curse Tablets and Binding Spells from the Ancient World* (New York, Oxford: Oxford U. Press)
- Gaitzsch (1980): Wolfgang Gaitzsch, "Eiserne römische Werkzeuge: Studien zur römischen Werkzeugkunde in Italien und den nördlichen Provinzen des Imperium Romanum," *British Archaeological Reports, International Series No. 78*, Oxford, 370, Taf. 50, 233.
- (1981): Wolfgang Gaitzsch, "'Ziegelstampfe' oder Trepan? Ein chirurgisches Instrument aus Niederbieber," *Das Rheinische Landesmuseum Bonn*, 2/81: 22–23. (See also an abbreviated version in *Antike Welt*, 12: 59).
- Gautier (1974): P. Gautier, "Le Typikon du Christ Sauveur Pantocrator," *Revue des Etudes Byzantines*, 32: 1–145.
- Gazzaniga (2000): V. Gazzaniga, "La Chirurgia a Roma, l' Evidenza dello Strumentario," *Medicina nei Secoli*, 12.1: 197–200.
- Gazzaniga, Serarcangeli (1999): V. Gazzaniga, C. Serarcangeli "Lo Strumentario Chirurgico Romano del Museo di Storia della Medicina dell' Università di Roma La Sapienza," *Medicina nei Secoli*, 11/1: 217–227.
- Gianfrotta (1986): P.A. Gianfrotta, "Rinvenimenti archeologici sottomarini" in G. Guidotti, ed., *Le isole Pontine attraverso i tempi* (Rome): 213–222.
- Gibbins (1988): D. Gibbins, "Surgical instruments from a Roman shipwreck off Sicily," *Antiquity*, 63: 294–297.

- (1989): D. Gibbins, "The Roman Wreck c. A.D. 200 at Plemmirio, near Siracusa (Sicily)," *Int. Journal of Nautical Archaeology and Underwater Exploration*, 18.1: 1–25.
- Gibbins (1997): D. Gibbins, "More underwater finds of Roman medical equipment," *Antiquity*, 71: 457–9.
- Gilson (1983): Andrew G. Gilson, "A Group of Roman Surgical and Medical Instruments from Cramond Scotland," *Medizin-historisches Journal*: 384–393.
- Grimm (1936): P. Grimm, "Ein Arztbesteck der römischen Zeit von Aschersleben," *Archiv. Gesch. Med.*, 29: 104–109.
- Grmek, Gourevitch (1998): Mirko Grmek and Danielle Gourevitch, *Les maladies dans l'art antique* (Fayard, Paris).
- Gurlt (1898): E. Gurlt, *Geschichte der Chirurgie und ihrer Ausübung*, 3 vols. (Berlin, Hirschwald).
- Habrich, Künzl, Zimmermann (1991): C. Habrich, E. Künzl, S. Zimmermann, *Theodor Meyer-Steineg (1873–1936), Arzt, Historiker, Sammler* (Ingolstadt,) = *Kataloge des Deutschen Medizinhistorischen Museums Ingolstadt*, Heft 11.
- Hamarnah, Awad (1977): Sami Hamarnah, Henri Awad, "Early Surgical Instruments Excavated in Old Cairo, Egypt," *International Surgery*, 62, no. 10: 520–524.
- Hamilton (1986): J.S. Hamilton, "Scribonius Largus on the Medical Profession," *Bulletin of the Hist. of Medicine*, 60: 209–216.
- Hanson (1994): Ann Ellis Hanson, "A division of labor: roles for men in Greek and Roman births," *Thamyris* 1 2: 157–202.
- Hassel, Künzl, (1980): F.J. Hassel, E. Künzl, "Ein römisches Arztgrab des 3. Jahrhunderts n. Chr. aus Kleinasien," *Medizin-historisches Journal*, 15: 403–421.
- Hausrath, Hunger (1970): A. Hausrath, H. Hunger, eds., *Corpus Fabularum Aesopiarum*, vols. 1.1 & 2.1, 2nd edition (Leipzig: Teubner).
- Haussmann (1878): D. Haussmann, "Geschichtliche Untersuchungen über das Speculum matricis," *Zeitschrift für Geburtshilfe und Gynäkologie*, 3, 366–388 mit 1 Doppeltafel.
- Heres (1992): Huberta Heres, "Ein römisches Arztkäschen aus Kyzikos," in Antje Krug, ed., *From Epidaurus to Salerno, Symposium held at the European University Centre for Cultural Heritage, Ravello, April, 1990* = *PACT, Journal of the Centro Universitario Europeo per i Beni Culturali*, 34: 157–165.
- Hershkovitz (1996): Malka Hershkovitz, "A Roman Cupping Vessel from the Masada Excavations," in Klaus Fittschen and Gideon Foerster, eds., *Judea and the Greco-Roman World in the Time of Herod in the Light of Archaeological Evidence, etc.*, (Göttingen: Vandenhoeck and Ruprecht).
- Herzog (1931): R. Herzog, *Die Wunderheilungen von Epidauros* = *Philologus Supp.* 22, Heft 3 (Leipzig: Dieterich).
- Hillert (1990), Andreas Hillert: *Antike Ärztedarstellungen, Marburger Schriften zur Medizingeschichte* 25 (Frankfurt am Main, New York: P. Lang).

- Höckmann (1972): U. Höckmann, *Antike Bronzen, Eine Auswahl* (Kassel: Staatliche Kunstsammlungen).
- Humphrey, Oleson, Sherwood (1998): John W. Humphrey, John P. Oleson, and Andrew N. Sherwood, *Greek and Roman Technology: A Sourcebook* (London and New York: Routledge).
- Jackson (1986): Ralph Jackson, "A Set of Roman Medical Instruments from Italy," *Britannia*, 17: 119–167.
- (1988): Ralph Jackson, *Doctors and Diseases in the Roman Empire*, (London and Norman, Oklahoma: British Museum and University of Oklahoma Press).
- (1990a): Ralph Jackson, "Roman doctors and their instruments: recent research into ancient practice," *Journal of Roman Archaeology*, 3: 5–27.
- (1991): Ralph Jackson, "Roman bivalve dilators and Celsus' 'instrument like a greek letter—' (De med. VII, 5, 2 B)," in Guy Sabbah, ed., *Le Latin Médical, La Constitution d' un Langue Scientifique* (Saint-Étienne: Publications de L'université de Saint-Étienne), 101–108.
- (1992): Ralph Jackson, "Staphylagra, Staphylocaustes, Uvulectomy and Haemorrhoidectomy: the Roman Instruments and Operations," in Antje Krug, ed., *From Epidaurus to Salerno, Symposium held at the European University Centre for Cultural Heritage, Ravello, April, 1990 = PACT, Journal of the Centro Universitario Europeo per i Beni Culturali* 34: 167–185.
- (1993): Ralph Jackson, "Roman Medicine: the Practitioners and their Practices," in W. Haase and H. Temporini, eds., *Aufstieg und Niedergang der römischen Welt*, Pt. II, Vol. 37, 1 (Berlin and New York: Walter de Gruyter), 79–101.
- (1994): Ralph Jackson, "The surgical instruments, appliances and equipment in Celsus' De Medicina)," in Guy Sabbah, Philippe Mudry, eds., *La médecine de Celse, aspects historiques, scientifiques et littéraires* (Saint-Étienne: Publications de l'Université de Saint-Étienne, 1994), 167–209.
- (1995): Ralph Jackson, "The composition of Roman medical instrumentaria as an indication of medical practice: a provisional assessment," in Ph. J. van der Eijk, H.F.J. Horstmanshoff, P.H. Schrijvers, eds., *Ancient Medicine in its Socio-Cultural Context = Clio Medica*, vol. 27 (Amsterdam-Atlanta, Ga., Rhodopi), vol. 1, 189–207.
- (1996): Ralph Jackson, "Eye Medicine in the Roman Empire," in W. Haase and H. Temporini, eds., *Aufstieg und Niedergang der römischen Welt*, Pt. II: *Principat*, vol. 37, 3 (Berlin and New York: Walter de Gruyter), 2228–2251.
- (1997a): Ralph Jackson, "An ancient British medical kit from Stanway, Essex," *The Lancet*, 350: 1471–73.
- (1997b): Ralph Jackson, "A Novel Roman Forceps," *The Ashmolean* 33, Christmas, 1997: 15–16.
- (1999): Ralph Jackson, "Spas, waters, and hydrotherapy in the Roman World," in J. Delaine, D.E. Johnston, eds., *Roman Baths and Bathing, Proceedings of the First*

- International Conference on Roman Baths held at Bath, England, 30 March–4 April 1992*, Pt. 1: Bathing and Society = *Journal of Roman Archaeology*, Supp. Series 37: 107–116.
- (2002): Ralph Jackson: “Roman Surgery: The Evidence of the Instruments,” in ed. R. Arnott, ed., *The Archaeology of Medicine: Papers Given at a Session of the Annual Conference of the Theoretical Group Held at the University of Birmingham on 20 December 1998* = *British Archaeological Reports (BAR) International Series* 1046 (Oxford: Archeopress), 87–94.
- (2003): Ralph Jackson: “The Domus ‘del chirurgo’ at Rimini: an interim account of the medical assemblage,” *Journal of Roman Archaeology*, 16: 312–22.
- (2005): Ralph Jackson, “Holding on to Health? Bone Surgery and instrumentation in the Roman Empire,” in Helen King, ed., *Health in Antiquity*, (Routledge: London and New York), 97–119.
- (2007a): Ralph Jackson, “The surgical instruments” in P. Crummy et al. *Stanway: an élite burial site at Camulodunum* (Britannia Monograph 24, London), 236–252.
- (2007b): Ralph Jackson, “Recent important discoveries of Roman surgical instruments,” in L. Melillo, ed., *storia della medicina, scienza dell’uomo*. Atti del convegno internazionale Napoli 22–23 ottobre 1998 (UNO, Napoli), 17–26.
- (2008): Ralph Jackson, “Imagining health-care in Roman London,” in J. Clark et al. (eds.) *Londinium and beyond: essays on Roman London and its hinterland for Harvey Sheldon* (Council for British Archaeology Research Report 156, London), 194–200.
- (2009a): Ralph Jackson, “The role of urban healers in the Roman World,” in S. De Carolis, V. Pesaresi, eds., *Atti del Convegno internazionale: Medici e pazienti nell’antica Roma, Rimini 12 giugno 2008* = *Il Bollettino dell’Ordine dei Medici Chirurghi e degli Odontoiatri della Provincia di Rimini*, 9 (anno IX, n. 1–2) Gennaio/Dicembre 2008: 57–83.
- (2009b): Ralph Jackson, “Lo Strumentario chirurgico della domus riminese / The Surgical Instrumentation of the Rimini Domus,” in S. De Carolis, ed., *Ars Medica. I ferri del mestiere. La domus ‘del chirurgo’ di Rimini e la chirurgia nell’antica Roma* (Rimini, Guaraldi), 73–91.
- (2010): Ralph Jackson, “Cutting for Stone: Roman Lithotomy Instruments in the Museo Nazionale Romano,” *Medicina nei Secoli*, 22/1–3: 393–418.
- (forthcoming): Ralph Jackson, “Back to basics: surgeons’ knives in the Roman world,” in D. Michaelides, ed., *Medicine and Healing in the Ancient Mediterranean world. Proceedings of the conference, Nicosia, 27–29 September 2008* (Oxbow: David Brown, projected pub. date of 2014), 130–144.
- Jackson, Leahy (1990b): Ralph Jackson, and Kevin Leahy, “A Roman Surgical Forceps from near Littleborough and a Note on the Type,” *Britannia*, 21: 271–274.

- Jakielski, Notis (2000): Katherine E. Jakielski and Michael R. Notis, "The Metallurgy of Roman Medical Instruments," *Materials Characterization*, 45: 379–389.
- Johnston (1957): Mary Johnston, *Roman Life* (Chicago, etc.: Scott, Foresman and Co.).
- Kanowski (1984): M.G. Kanowski, *Containers of Classical Greece: a Handbook of Shapes* (St. Lucia, Queensland, New York: University of Queensland Press, Lawrence, Mass.).
- Kanz, Grossschmidt (2006): Fabian Kanz and Karl Grossschmidt, "Head Injuries of Roman Gladiators," *Forensic Science International*, 160: 207–216.
- (2009): Fabian Kanz and Karl Grossschmidt, "Dying in the Arena: The Osseous Evidence from Ephesian Gladiators," in Tony Wilmot, ed., *Roman Amphitheatres and Spectacula: a 21st-Century Perspective. Papers from an international conference held at Chester, 16th–18th February, 2007 = British Archaeological Reports (BAR) International Series 1946* (Oxford: Archeopress), 211–220.
- Keyser and Irby-Massie (2008): Paul Keyser, Georgia Irby Massie, eds., *The Encyclopedia of Ancient Natural Scientists* (London and New York: Routledge).
- Kirkup (2006): John Kirkup, *The Evolution of Surgical Instruments* (Novato, California: Norman Publishing).
- Kirova (2002): N. Kirova, "Specialized Medical Instruments from Bulgaria in the Context of Finds from Other Roman Provinces (1–IV C AD)," *Archaeologia Bulgarica* 6 (1): 73–94.
- Korpela (1987): J. Korpela, *Das Medizinpersonal im antiken Rom: eine sozialgeschichtliche Untersuchung. Annales Academiae Scientiarum Fennicae*: Diss. Hum. Litt. 45 (Helsinki: Suomalainen Tredekatemia).
- Krämer (2000): Karin Krämer, *Die antiken Instrumente des Deutschen Medizinhistorischen Museums Ingolstadt, Realienkundliche Untersuchung und Katalog* (Ingolstadt: Max Reindl) = *Kataloge des Deutschen Medizinhistorischen Museums*, Heft 19.
- Krug (1985): Antje Krug, *Heilkunst und Heilkult, Medizin in der Antike* (Munich: C.H. Beck).
- (1992): Antje Krug, "Medizin und Ärzteswesen," in Werner Jobst, ed., *Carnuntum, Das Erbe Roms an der Donau: Katalog der Ausstellung des Archäologischen Museums Carnuntum in Bad Deutsch Altenburg* (Wien: Amt der Niederösterreichischen Landesregierung), 153–161.
- (1993): Antje Krug, "Römische Skalpelle, Herstellungstechnische Anmerkungen." *Medizinhistorisches Journal*, 28.1: 93–100.
- (2008): Antje Krug, *Das Berliner Arztrelief, = Winckelmannsprogramm der Archäologischen Gesellschaft zu Berlin*, 142 (Berlin: Walter de Gruyter).
- (2012): Antje Krug, "Doktorspiele?—Der Aryballos Peytel," *Boreas, Münstersche Beiträge zur Archäologie* 35: 11–23.
- Krunić (1995): S. Krunić, "Why and How Silver had been Used in the Manufacture of Medical Instruments," in I. Popović, T. Cujeticanin and B. Borić- Brešković, eds.,

- Silver Workshops and Mints, Symposia Acta, Nov. 15–18, 1994, Nat. Mus. Belgrad* (Belgrade: Musée National de Belgrade), Monograph no. 9, 216 ff.
- Kühn (1827–1828), Carl G. Kühn, “De instrumentis chirurgicis, veteribus cognitis et nuper effosis,” in *Opuscula Academica Medica et Philologica Collecta, Aucta et Emendata* (Leipzig: Sumptibus L. Vossii), Vol. II, 306–319.
- Künzl (1982a): E. Künzl, “Ventosae cucurbitae romanae? Zu einem angeblich antiken Schröpfkopftypus,” *Germania*, 60: 513–32.
- (1982b): E. Künzl, “Was soll die Maus auf dem chirurgischen Instrument?,” in J. Thimme, D. Metzler, Brinna Otto, Ch. Müller-Wirth, eds., *Antidoron: Festschrift für Jürgen Thimme* (Karlsruhe: C.F. Muller), 111–116.
- (1983a): Ernst Künzl, with the collaboration of F.J. Hassel and S. Künzl, *Medizinische Instrumente aus Sepulkraffunden der römischen Kaiserzeit* (Bonn: In Kommission bei R. Habelt, 1983) = *Sonderdruck aus den Bonner Jahrbüchern*, Bd. 182, 1982.
- (1983b): E. Künzl, “Eine Spezialität römischer Chirurgie: die Lithotomie,” *Archäologisches Korrespondenzblatt*, 13: 487–493.
- (1984a): E. Künzl, “Einige Bemerkungen zu den Herstellern der römischen medizinischen Instrumente,” *Alba Regia*, 21: 59–65.
- (1984b): E. Künzl, “Medizinische Instrumente der Römerzeit aus Trier und Umgebung im Rheinischen Landesmuseum Trier,” *Trierer Zeitschrift*, 47: 153–237.
- (1986a): Ernst Künzl: “Operationsräume in römischen Thermen,” *Bonner Jahrbücher*, 186: 492–509.
- (1986b): Ernst Künzl, “Eine Serie von Fälschungen römischer medizinischer Instrumentarien,” *Archäologisches Korrespondenzblatt*, 16: 333–339.
- (1991a): E. Künzl, “Die archäologischen Objekte der Sammlung Meyer-Steineg in Jena,” in C. Habrich, E. Künzl, S. Zimmermann, *Theodor Meyer-Steineg (1873–1936), Arzt, Historiker, Sammler*, (Deutsches Medizinhistorisches Museum: Ingolstadt), 23–73.
- (1991aa): E. Künzl, “Die Instrumenten aus Ephesos und Kos,” in S. Zimmermann, E. Künzl, *Die Antiken der Sammlung Meyer-Steineg in Jena, I, Sonderdruck aus Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, 38: 519–540.
- (1991b): E. Künzl, “Die medizinische Versorgung der römischen Armee zur Zeit des Kaisers Augustus und die Reaktion der Römer auf die Situation bei den Kelten und Germanen,” in Rudolf Asskamp, Stephan Berke, eds., *Die römische Okkupation nördlich der Alpen zur Zeit des Augustus, Kolloquium Bergkamen 1989 Vorträge* (Münster: Aschendorf), 185–202.
- (1992): Ernst Künzl, “Spätantike und byzantinische medizinische Instrumente,” in Antje Krug, ed., *From Epidaurus to Salerno, Symposium held at the European University Centre for Cultural Heritage, Ravello, April, 1990* = *PACT, Journal of the Centro Universitario Europeo per i Beni Culturali* 34: 201–244.

- (1993): E. Künzl, "Ein unvorsichtiger Arzt? Römisches Bronzebesteck mit chirurgischen Werkzeugen, aus dem Rhein gebaggert bei Mainz," in Bernhard Pinsker, ed., *200 000 Jahre Kultur und Geschichte in Nassau dargestellt an Objekten der Sammlung Nassauischer Altertümer des Museums Wiesbaden* (Wiesbaden, Verlag des Vereins für Nassauische Altertumskunde und Geschichtsforschung), 99–102.
- (1994): Ernst Künzl, "Die Geburt des Kaisers Augustus? Zu den Hintergründen einer medizinhistorischen Fälschung," *Archäologisches Korrespondenzblatt*, 24: 403–5.
- (1995): E. Künzl, Ein archäologisches Problem: Gräber römischer Chirurginnen," in Ph. J. van der Eijk, H.F.J. Horstmannshoff, P.H. Schrijvers, eds., *Ancient Medicine in its Socio-Cultural Context = Clio Medica* vol. 27 (Rhodopi: Amsterdam-Atlanta, Ga., 1995), vol. 1, 309–319.
- (1996): E. Künzl, "Forschungsbericht zu den antiken medizinischen Instrumenten," in W. Haase, H. Temporini, eds., *Aufstieg und Niedergang der römischen Welt*, Pt. 11: *Principat*, Vol. 37, 3 (Berlin and New York: Walter de Gruyter), 2434–2639.
- (1998): E. Künzl, "Zur Typologie von Klammern und Pinzetten," *Saalburg Jahrbuch* 49, 76–82.
- (1999): Ernst Künzl, "Ärzte in Ephesos: Gräber und Instrumente," in H. Friesinger, F. Krinzing, eds., *100 Jahre Österreichische Forschungen in Ephesos = Archäologische Forschungen*, 1: 205–209.
- (2002a): Ernst Künzl, *Medizin in der Antike, aus einer Welt ohne Narkose und Aspirin* (Stuttgart: Konrad Theiss).
- (2002b): E. Künzl, *Medizinische Instrumente der römischen Kaiserzeit im Römisch-Germanischen Zentralmuseum* (Mainz: Verlag RGZM).
- Künzl, Weber: (1991): Ernst Künzl, Thomas Weber, "Das spätantike Grab eines Zahnarztes zu Gadara in der Dekapolis," *Damaszener Mitteilungen*, 5: 81–118, plus 7 plates.
- Lambrinoudakis (1976): B.K. Lambrinoudakis, Ανασκαφή στο ιερό του Απόλλωνος Μαλεάτα, Πρακτικά της Αρχαιολογικής Επερείας, 4: 202–209.
- Lambros (1895): K.P.I. Lambros, περί σικύων καὶ σικυάσεως παρὰ τοῖς ἀρχαίοις (Athens: Typ. "Palingenesias" J. Angelopoulou).
- Longfield-Jones (1978): G.M. Longfield-Jones, "Uses of Metals, their Compounds and Alloys," in J.F. Healy, ed., *Mining and Metallurgy in the Greek and Roman World* (London: Thames and Hudson), 246–251.
- (1986): G.M., Longfield-Jones, "A Graeco-Roman Speculum in the Wellcome Museum," *Medical History*, 30: 81–89.
- Lopez-Salva (1999): Mercedes Lopez-Salva, "Terapia Quirúrgica in el Corpus Hippocraticum: Estudio Léxico del Instrumental," in Ivan Garofalo, Alessandro Lami, Daniela Manetti, and Amneris Roselli, eds., *Aspetti della terapia nel Corpus Hippocraticum: Atti del IXe Colloque International Hippocratique*, Pisa 25–29 Settembre 1996 (Florence: Leo S. Olschki) 299–312.

- Lund (1936): Fred B. Lund, *Greek Medicine* (New York: Paul B. Hoeber/Harper & Bros) = *Clio Medica*, E.B. Krumbhaar, ed., vol. 18.
- Majno (1975): Guido Majno, *The Healing Hand: Man and Wound in the Ancient World* (Cambridge, Mass., and London: Harvard University Press).
- Manni (1984): J.J.Manni, "Uvulectomy, a traditional surgical procedure in Tanzania," *Annals of Tropical Medicine and Parasitology*, 78(1): 49–53.
- Marganne (1994): M.-H. Marganne, *L'ophtalmologie dans l'Égypte gréco-romaine d'après les papyrus littéraires grecs* (Brill: Leiden, New York, Köln) = *Studies in Ancient Medicine*, 8.
- (1998): M.-H. Marganne, *La chirurgie dans l'Égypte gréco-romaine d'après les papyrus littéraires grecs* (Brill: Leiden, Boston, Köln) = *Studies in Ancient Medicine*, 17.
- Marganne-Mélard (1987): Marie-Hélène Marganne-Mélard, "Les instruments chirurgicaux de l'Égypte gréco-romaine," in *Archéologie et Médecine, VIIèmes Rencontres Internationales d'Archéologie et d'Histoire, Antibes, Octobre 1986* (Éditions Association pour la promotion et la diffusion des connaissances archéologiques, Juan-les-Pines).
- Mariani-Costantini et al. (2000): R. Mariani-Costantini, P. Catalano, F. di Gennaro, G. di Tota, and L.R. Angeletti, "New Light on Cranial Surgery in Ancient Rome," *The Lancet*, 355: 305–307.
- Marketos, Laskaratos, Malakates (1994): S.G. Marketos, J. Laskaratos and S. Malakates, "The first record of lithotripsy in the early Byzantine era," *Brit. Journal of Urology*, 74: 405–408.
- Mau (1902): August Mau, *Pompeii, its Life and Art*, English trans. Francis W. Kelsey (MacMillan: New York, London).
- Mazzini (1996): I. Mazzini, "Embrulcia ed embriotomia: evoluzione e diffusione di due interventi ginecologici atroci nel mondo antico, in M. Vegetti and Silvia Gastaldi, eds., *Studi di storia della medicina antica e medievale in memoria di Paola Manuli*" (Firenze: La Nuova Italia), 21–33.
- McWhirr, Viner, Wells (1982): A. McWhirr, L. Viner, C. Wells, *Romano-British Cemeteries at Cirencester, Cirencester Excavations II, Cirencester, Fiche 2/5. CO3, CO4, Fig. 58, No. 106*.
- Meyer-Steineg (1912): Theodor Meyer-Steineg, *Chirurgische Instrumente des Altertums* (Jena: Gustav Fischer).
- Michaelides (1984), Demetrios Michaelides, "A Roman Surgeon's Tomb from Nea Paphos," *Report of the Department of Antiquities Cyprus*, Part 1 (Nicosia: Dept. of Antiquities, Cyprus), 315–332. The instruments from this tomb have now been beautifully photographed by A. Koutas and presented as illustrations in D. Michaelides' chapter Γιατροί και Ιατρικά στην Αρχαία Κύπρο, in *Η Ιατρική στην Κύπρο, Από την Αρχαιότητα μέχρι την Ανεξαρτησία* (Politistiko Kentro Omilou Laikis, Leucosia, 2006), 13–68.

- Michler (1968–): Markwart Michler, *Die hellenistische Chirurgie* (Wiesbaden: Steiner) = first volume of an enlarged ed. of the author's Habilitationsschrift, *Die alexandrinischen Chirurgen* (Hamburg).
- (1972): Markwart Michler, *Die Hand als Werkzeug des Arztes: eine kurze Geschichte der Palpation von den Anfängen bis zur Gegenwart* (Stuttgart: Steiner Verl. Wiesbaden) = *Beiträge zur Geschichte der Wissenschaft und der Technik*, 12.
- Milne (1907), John Stewart Milne, *Surgical Instruments in Greek and Roman Times* (Oxford: Clarendon Press; repr. New York: Augustus M. Kelley, 1970).
- (1939): Marjorie J. Milne “Kulichnis,” *Am. Journal of Archaeology*, 43: 247–54.
- Minchev (1983): Alexander Minchev, “Roman Medicine in Marcianopolis,” *Concilium Eirene XVI. Proceedings of the 16th International Eirene Conference, Prague 31. 8.–4. 9., 1982* (Prague: Kabinet pro studia recka, rimska a latinska CSAV), vol. 2, 143–148.
- Museum Würth (1995): Barbara Deppert-Lippitz, Reinhold Würth, Dieter Planck, Rüdiger Krause et al., *Die Schraube zwischen Macht und Pracht, Das Gewinde in der Antike* = Exhibition Catalogue Museum Würth and Archäologisches Landesmuseum Baden-Württemberg (Sigmaringen: Jan Thorbecke), 41–45, 180–187.
- Mutz (1972), Alfred Mutz, *Die Kunst des Metalldrehens bei den Römern* (Birkhauser: Basel and Stuttgart).
- Nikolaou (1989): I. Nikolaou, “Les bouillottes thérapeutiques de Paphos et leurs parallèles hors de Chypre,” *Bulletin de Correspondance Hellénique* 113: 301–318.
- Nutton (1995): Vivian Nutton, “The Medical Meeting Place,” in Ph. J. van der Eijk, H.F.J. Horstmannshoff, P.H. Schrijvers, eds., *Ancient Medicine in its Socio-Cultural Context = Clio Medica* vol. 27 (Amsterdam-Atlanta, Ga., Rhodopi) vol. 1, 3–27.
- (2004; 2nd ed. 2013.): Vivian Nutton, *Ancient Medicine* (London and New York: Routledge).
- (2014): Vivian Nutton, Review of Daniş Baykan, *Allianoi Tıp Aletleri*: in *Medical History*, 58: 122–125.
- Önnerfors (1975): Alf Önnerfors, *Physica Plinii Bambergensis* (Hildesheim: G. Olms).
- Ortalli (2000): J. Ortalli, “Rimini: la domus ‘del chirurgo,’” in M.M. Calvani, *Aemilia, la cultura romana in Emilia Romagna dal IIIsecolo a. C. all’ eta costantiniana* (Venice: Marsilio), 513–26.
- (2007): J. Ortalli, “Il medicus di Ariminum: una contestualizzazione archeologica dalla domus ‘del chirurgo,’” *Rivista storica dell’ antichità*, 37: 101–118.
- (2009): Jacopo Ortalli, “Archeologia e medicina: la casa del ‘Chirurgo’ riminese,” in S. De Carolis, ed., *Ars medica. I ferri del mestiere. La domus ‘del chirurgo’ di Rimini e la chirurgia nell’antica Roma* (Guaraldi, Rimini), 21–45.
- Pantermalis (1997): Demetrios Pantermalis, Η ΑΝΑΣΚΑΦΗ ΤΟΥ ΔΙΟΥ ΚΑΤΑ ΤΟ 1993 ΚΑΙ Η ΧΑΛΚΙΝΗ ΔΙΟΠΤΡΑ, in ΤΟ ΑΡΧΑΙΟΛΟΓΙΚΟ ΕΡΓΟ ΣΤΗ ΜΑΚΕΔΟΝΙΑ ΚΑΙ ΘΡΑΚΗ, Ministry of Culture, Ministry of Macedonia and Thrace, The Aristotelian University of Thessalonica, 7, 1993, (Thessalonika, 1997), 195–198.

- Penn (1994): R.G. Penn, *Aspects of Medicine on Ancient Greek and Roman Coins* (Batsford: London).
- Perone (1990), Nicola Perone, "Did the Romans Know About the Use of Forceps?," *Southern Medical Journal*, 83: 555–556.
- Phillips (1973): E.D. Phillips, *Greek Medicine* (London: Thames and Hudson).
- Pleket (1995): H.W. Pleket, "The Social Status of Physicians in the Greco-Roman World", in Ph. J. van der Eijk, H.F.J. Horstmanshoff, P.H. Schrijvers, eds., *Ancient Medicine in its Socio-Cultural Context* (Amsterdam-Atlanta, Ga.: Rhodopi), vol. 1, 27–34.
- Pormann (2004): Peter E. Pormann, *The Oriental Tradition of Paul of Aegina's Pragmateia* (Leiden and Boston: Brill, 2004) = *Studies in Ancient Medicine*, vol. 29.
- Pournaropoulos (1973): K.G. Pournaropoulos, TA IATPIKA EPΓAAEIA TΩN APXAIΩN EΛΛHNΩN (Athens, Doctoral Thesis).
- Powell (2007): Barry B. Powell, *Classical Mythology*, 5th ed. (Upper Saddle River New Jersey: Pearson Prentice Hall).
- Proff (1992): Peter Proff, "Lösungswege zur funktionellen Deutung griechisch-römischer medizinischer Instrumente," *Sudhoffs Archiv*, 76 (2): 179–196.
- Radnóti (1938): A. Radnóti, *Die römischen Bronzegefäße von Pannonien* (Budapest: Institut für münzkunde und archäologie der Pázmány-universität).
- Reisner, Fisher, Lyon (1924): G.A. Reisner, C.S. Fisher, D.G. Lyon, *Harvard Excavations at Samaria 1908–1910* (Cambridge: Harvard University Press).
- Renahan (2000): R. Renahan, "A Rare Surgical Procedure in Plutarch," *Classical Quarterly*, 50 (1): 223–229.
- Ricci (1949): J.V. Ricci, *The Development of Gynecological Surgery and Instruments* (Philadelphia: Blakiston).
- Richter (1915): G.M.A. Richter, *Greek, Etruscan, and Roman Bronzes* (New York: The Gilliss Press).
- Riddle (1985): John M. Riddle, *Dioscorides on Pharmacy and Medicine* (Austin: University of Texas Press, 1985; rptd. 2011).
- (1992): John M. Riddle, *Contraception and Abortion from the Ancient World to the Renaissance* (Cambridge, Mass. and London: Harvard University Press).
- Rieche, Schalles (1987): A. Rieche, H.J. Schalles, *Colonia Ulpia Traiana, etc.* = Führer und Schriften des Archäologischen Parks Xanten, 10 (Köln, Rheinland Verlag GMBH).
- Rieck (1932): Wilhelm Rieck, *Das Veterinär-Instrumentarium im Wandel der Zeiten und seine Förderung durch die Instrumentenfabrik* (H. Hauptner: Sonderdruck aus dem Jubiläums-Katalog der Firma H. Hauptner, Berlin).
- Riethe (1989): Peter Riethe, "Traktat über römische Zange," *Zahnärztliche Mitteilungen*, 79: 892–902.
- Riha (1986): Emilie Riha, with the collaboration of M. Joos, J. Schibler, W.B. Stern, *Römisches Toilettgerät und medizinische Instrumente aus Augst und Kaiseraugst* (Augst: Römermuseum Augst) = *Forschungen in Augst*, Bd. 6.

- Robinson (1941): D.M. Robinson, *Excavations at Olynthus, pt. x, Metal and Minor Miscellaneous Finds* (Baltimore: Johns Hopkins University Press).
- Rueff (1580): Jacob Rueff, *De Conceptu et Generatione Hominis de Matrice et eius partibus, nec non de Conditione Infantis in Utero, etc.* (Francoforti ad Moenum).
- Salazar (1998): Christine F. Salazar, "Getting the point: Paul of Aegina on Arrow Wounds," *Sudhoff's Archiv* 82 (2): 170–187.
- (2000): Christine F. Salazar, *The Treatment of War Wounds in Greco-Roman Antiquity* (Leiden, Boston, Cologne: Brill) = *Studies in Ancient Medicine* 21.
- Scarborough (1969): John Scarborough, *Roman Medicine* (Ithaca: Cornell University Press, repr. 1976).
- (2010): John Scarborough, "Teaching Surgery in late Byzantine Alexandria," in Manfred Horstmanshoff, ed., *Hippocrates and Medical Education = Studies in Ancient Medicine*, vol. 35 (Leiden and Boston: E.J. Brill): 235–260.
- (2011): John Scarborough, "Ancient Medicinal Use of *Aristolochia*: Birthwort's Tradition and Toxicity," *Pharmacy in History* 53 (1): 3–21.
- (2012a): John Scarborough, "Pharmacology and Toxicology at the Court of Cleopatra VII: Traces of Three Physicians," in Anne van Arsdall, Timothy Graham, eds., *Herbs and Healers from the Ancient Mediterranean through the Medieval West, Studies in Honor of John M. Riddle* (Ashgate: Farnham and Burlington), 7–18.
- (2012b): John Scarborough, "Thornapple in Graeco-Roman Pharmacology," *Classical Philology*, 107 (2012), 247–255.
- (2013): John Scarborough, "Theodora, Procopius, and Aetius of Amida: Some Possible Connections," *Greek Roman and Byzantine Studies* 53: 742–762 [Published version {electronic} in slightly different format; n. 49 becomes 'Appendix,' "Drugs and the Law"].
- (2014a): John Scarborough, "Hernia Repair in Roman and Byzantine Surgery," [forthcoming] *Sudhoff's Archiv* 2014.
- (2014b): John Scarborough, "Fish Glue (Grk. ἰχθυοκόλλα) in Hellenistic and Roman Medicine and Pharmacology," [forthcoming] *Classical Philology*, 109 (2014).
- Schäfer (1999): D. Schäfer, *Geburt aus dem Tod: Der Kaiserschnitt an Verstorbenen in der abendländischen Kultur. Schriften zur Wissenschaftsgeschichte*, 20. (Hürtgenwald: Pressler).
- Schaltenbrand Obrecht (2012): Verena Schaltenbrand Obrecht, *Stilus. Kulturhistorische, typologisch-chronologische und technologische Untersuchungen an römischen Schreibgriffeln von Augusta Raurica und anderen Fundorten. Katalog und Tafeln* (2 vols.). *Forschungen in Augst* 45/Bd. 1–2 (Basel: Schwabe).
- Sevilla (1922): M.H.-J. Sevilla, "l'Art vétérinaire antique, considérations sur les saignées pratiquées par les hippiatres grecs," *Comptes-rendus du deuxième congrès international d'histoire de la médecine, Paris juillet 1921* (Evreux: Hérissé), 77–96.

- Sigerist (1951, 1961): Henry Sigerist, *A History of Medicine*, 2 vols. (New York: Oxford University Press).
- Simpson (1977): Grace Simpson, "Early Roman Metal Objects from the Excavations at Neuss," in *Studien zu den Militärgrenzen Roms II* (Köln: Rheinland Verlag; Bonn: Rudolph Habelt) = *Beihefte der Bonner Jahrbücher*, 38: 562–564.
- Snyder (1972): G. Snyder, *Instrumentum Medici* (Ingelheim a. Rhein: C.H. Boehringer u. Sohn).
- Sobel (1991): Hildegard Sobel, "Römische Arzneikästchen," *Saalburg-Jahrbuch*, 46: 121–147.
- Spawforth (1990): A.J.S. Spawforth, "Roman medicine from the sea," *Minerva* 1: 9–10.
- Stacey (2011): R.J. Stacey, "The composition of some Roman medicines: evidence for Pliny's Punic Wax?," *Analytical and Bioanalytical Chemistry*, 401 (6): 1749–1759 (DOI: 10.1007/s00216-011-5160-7).
- Steinhauer (2001): G. Steinhauer, Τὸ Αρχαιολογικὸ Μουσεῖο Πειραιῶς (Athens, EFG Eurobank Ergasias).
- Sudhoff (1922): K. Sudhoff, *Geschichte der Medizin im Überblick mit Abbildungen* (Jena: G. Fischer).
- (1926): K. Sudhoff, "Mutterrohr und Verwandtes, usw.," *Arch. Gesch. Medizin*, 18: 51–112.
- Tabanelli (1956): Mario Tabanelli, *Chirurgia nell'Antica Roma* (Turin: Minerva Medica).
- (1958): Mario Tabanelli, *Lo Strumento Chirurgico e la sua Storia* (Forlì: Romagna Medica).
- Tarbell (1909): Frank Tarbell, *Catalogue of Bronzes etc., in the Field Museum of Natural History, etc.* (Field Museum of Natural History Publication 13: Chicago).
- Thompson (1942): C.J.S. Thompson, *The History and Evolution of Surgical Instruments* (New York: Schuman).
- Toledo-Pereyra (1973): Luis Toledo-Pereyra, "Galen's Contribution to Surgery," *J. of the History of Medicine*, 28: 357–375.
- Torzioglu, Krebs (1980): A. Torzioglu and L.M. Krebs, *The History of Turkish Dentistry* (Munich: Demeter Verlag).
- Troisi (1981): Franca Ferrandini Troisi, "Un vasetto per medicinale con iscrizione Greca," *Archeologia Classica*, 33: 329–331.
- Tullo (2010): E. Tullo, "Trepanation and Roman medicine: a comparison of osteoarchaeological remains, material culture and written texts," *Journal of Royal College of Physicians of Edinburgh*, 40: 165–171.
- van der Eijk (2010): Philip van der Eijk, "Principles and Practices of Compilation and Abbreviation in the Medical 'Encyclopedias' of Late Antiquity," in Marietta Horster and Christiane Reitz, eds., *Condensing texts-condensed texts, = Palingenesia, Bd. 98; Klassische Philologie* (Stuttgart: Franz Steiner Verlag): 519–554.

- Van der Poel (1977–): H. Van der Poel, *Corpus Topographicum Pompeianum* (Rome, Italy: Edizioni dell'Elefante).
- Védrenes (1876): A. Védrenes, *Traité de Médecine de A.C. Celse* (Paris: G. Masson).
- Vulpes (1847): Benedetto Vulpes, *Illustrazione di Tutti gli Strumenti chirurgici Scavati in Ercolano e in Pompei, etc.* (Naples: Stamperia Reale).
- Weaver, Perry et alii (2000): David S. Weaver, George H. Perry, Roberto Macchiarelli, Luca Bondioli, "A surgical amputation in 2nd century Rome," *The Lancet* vol. 356, issue 9230 (August 19, 2000), 686.
- Wellmann (1914): Max Wellmann, *Die Schrift des Dioskurides Περί ἀπλῶν φαρμάκων: Ein Beitrag zur Geschichte der Medizin* (Berlin: Weidmann).
- Wells (1967): Calvin Wells, "A Roman Surgical Instrument from Norfolk," *Antiquity* 41: 139–141.
- Wild (1970): J.P. Wild, *Textile Manufacture in the Northern Roman Provinces* (Cambridge: Cambridge University Press).
- Witt (2009): Mathias Witt, *Weichteil und Vizeralchirurgie bei Hippokrates, ein Rekonstruktionsversuch der verlorenen Schrift ΠΕΡΙ ΤΡΩΜΑΤΩΝ ΚΑΙ ΒΛΑΩΝ* (Berlin and New York: Walter de Gruyter).
- Zervos (1932): S. Zervos, *Les bistouris, les sondes et les curettes chirurgicales d'Hippocrate* (Athens, 1932).
- Zipster, Fischer (2004): B. Zipster, K.-D. Fischer, "Neue Quellen zur Augenheilkunde: der lateinische Aphorismenkommentar Lat-A, The Syriac Book of Medicines und Theophilus Protospatharios," in Andorlini, ed., *Testi Medici su Papiro, Atti del Seminario di Studio, Firenze 3–4 giugno 2002* (Istituto Papirologico: G. Vitelli, Firenze), 3–28.

General Index

- abortion: (surgical) see embryotomy;
(pharmaceutical) 304, 333
- abscess, treatment of: lancing 81–89;
cauterizing 165, 171–172; positioning and
exposing 165, 175, 252, 255, 272; irrigating
215, 227, 229; fomenting 294; medicating
and dressing 299, 312, 322–324, 346–347
- Achillas the Cataract Coucher or Dropsy
Tapper 22n103
- Achilles (a sponge type) 33m149
- aegilops/aigilops (fistula lachrymalis):
perforator for 188; see also cauterization
- Aeneas, wounding of 241, 243
- Albucasis, illustrations of piston driven
syringe 215–219; and uvula knife 103
- Alexandria: training of surgeons 9;
invention of tools in Hellenistic
Period 54. See also Herophilus,
Erasistratus, Heron
- Allianoi (Turkey): surgical clinic? 11–12;
newly recovered instruments: bleeding
vessel 62, double spatula 122, socketed
needle 155, saw 184, elevator 204n518,
catheters 224, collared tube 226,
dentated spring forceps 236, uvula
forceps 244, hemostat 245–246,
dilator? 247n706
- Alliluyeva, S., leaching 61n23
- Ameipsias (comic poet) 227
- Ammonius, called 'The Lithotome' 52, 192
amphimele/amphimelon (= *dipyrene*)
117–118
- amphismile/amphismilon* 95–96
- amputation: Hippocratic vs. Hellenistic 51,
53; of preternatural fingers/supernumerary
digits 81, 192, 237; of extremities 82,
322; of nympha (probably clitoris) 237; of
peritoneum 180, 198; of uvula 90, 103,
236, 243–244; with saw 183, block 198,
and chisels 192; skeletal evidence
for 184
- anchor probe (*ankuromele*) 139
- anesthetics 20–22
- ankter* (stitch) 299–302
- Antyllus of Alexandria: on cupping 57 ff.;
on operating for fistula 128–129
- apolinosis (ligating anal fistula) 34, 105,
117–118, 124, 136–138, 306, 325
- Apollo: epithets (Lykios 20, Medicus 20);
shrine at Maleatas 50n102; temple at
Delphi 240
- Aretaeus of Cappodocia, description of nasal
clyster 213
- Aristophanes (comic poet): on ladle for black
eyes 56n2; on medicine containers 277
et passim; on linen for bandages 312
- Aristotle: on tooth extraction with fingers
206n527; on dental forceps 49, 239;
posing a riddle 59n12
- arteriotomy 123n221, 272, 305, 324, 326n134,
336
- ascitis, draining of 10, 51, 223–224
- Asclepius: motive on tools 19, 156, 177, 189,
267n788, 274; dedications to 24, 31, 41,
313
- Aspasia (excerpted by Aëtius): female
lithotomy 99n123; hydrocele of
womb 174; female catheterization
222n597; dystocia 222n600, 313n73; see
also female conditions, uterine growths
- assistants (surgical) 10
- Augsburg-Oberhausen, early example of
Imperial scalpel 73
- Augst (Switzerland): razors 107, ointment
slabs 268, shafts for stirring 293
- awl 262
- Baglioni, S., faked relief 259–260
- balanos* see suppositories
- Band of Antyllus 271
- basins/tubs 293–294
- bathing establishments associated with
surgery 5, 20, 126n230
- Bayardi, Antonio: *Catalogo* of finds in
Portici 2; identification of cannula as ear
syringe 216n572
- bellows see tubes
- bladder stone see lithotomy

- bleeding vessels/cups: Hippocratic 25–27, Imperial 57–72
- block/director: finger, spatula and guard (*meningophulax*) as 197–199; probe as, passim, especially 121–137; blind hook/retractor as 178
- blunt or blind hook see hooks/retractors
- bone forceps see forceps
- bone irrigator? 220
- boubonophulax* (truss for inguinal hernia) 343
- bow drill (*aris*) 39, 187–188; adapted from trades 203
- bow shears 107
- boxes, rectangular and cylindrical for storage 273–278
- breast: male breast reduction 149; cancer of 160–164; abscess of 322; excess of milk in 330
- brochos* (tourniquet, cord used for ligation, extension, etc.) 305–306
- canalis* see splints
- cancer: breast 160–164; malignant 165–166; prostate 222n597; womb 255
- cannulae* see tubes
- cataracts, ‘couching’ of 1, 52, 152–153
- catheter see tubes
- Cato the Elder: on trephining 189; on fumigation 296
- Cato the Younger, frustrated gastrorrhaphia of 22n102
- caustics and caustic forceps 150, 246
- cauterization 30–32, 157–172; natural substances used for 172–173
- cauteries: applied through a protective tube 167; caustic/cold cautery (see caustic forceps); lunated 168; needle 168; olivary 171 (see also olivary enlargement); razor as 166; scalpel as 159; serrated 169; shaped like knives, nails, bricks, lentils and the letter gamma 170; spatula 166; stylus as 167; triangular 168; trident 169; tube as 168
- Celsus: on competent surgeon 21; source of Hellenistic surgical developments 51 ff.
- Cercullius, son of treated by Galen 293
- chisels/gouges 191–194
- Chrysippus, attesting couching the cataract 153
- Cicero: on wound specialists 14; on ankyloglossia 84; divine origins of probe 109n176; on poisoning 276n832
- clystering, douching 208–211
- clyster tubes: nasal 213; uterine 212; irrigators for penis? 219, for bone? 220. See also ear clyster/syringe
- compresses 312, 321, 334, 336–337, 346; see also Appendix *pannus*, *ptugma*, *splen*, *splenion*
- contraception 304, 333
- cooking pots 285–291
- coudée forceps see forceps
- cranial caries 193
- cranioclast: Hippocratic 42; Imperial 257
- cupping see bleeding vessels/cups
- curette 199–200; for eyelids 127, 139; uterine 261
- ‘cyathiscomele’ see probes
- décor on tools 18–20
- Delphi, tooth forceps in Temple of Apollo 240
- Democedes of Croton 23, 50n103
- dilation: by probe 35–36; wedge 272–273; speculum 249–254
- Diocles of Carystus: scoop designed by 52 102, 142–143; reduction of prolapsed uterus 230
- Dion/Dium (Greece), speculum found in shop for repair 14, 254–255
- dislocations 40, 51, 157, 230, 294, 308
- double spatula 122–123, 206
- drills: crown 38–39, 184n434, 185–189; straight 39
- Dürnberg, Katzelsdorf, Guntramsdorf (all Austria), trephined skulls from 187n444
- ear clyster/syringe 214–217
- ears: cleaning/clearing of foreign objects 52, 136, 235, 315; occlusion 91; tumor called parotis 65, 83n74
- Egyptian Creator Gods 254n731

- embryo hook, embryotomy:
 Hippocratic 42–44, Imperial 255–259
- empyema (treatment of): Hippocratic 29, 47–48; leeches 318; cauterization 163, 171, 173; lance and drain 224–225; regulation of drainage by cloth or sponge plugs 325, 335, 341
- Epiphanius, bishop of Alexandria, on hupospathismos 206
- Erasistratus of Iulis, relationship to catheter 47, 54, 221; and stylet for abortion 256
- Erotian: on *hupaleiptron* 37; on *ankuromele* 42, 139; on rectal speculum and spoon probe 133–134
- Eunicus (comic poet) 287n909
- eyes, eyelids (diseases, treatments of): see especially 63–64, 81–82, 112, 115, 136, 139–140, 149–158, 162, 174–175, 346; see also suture knife, knife for excision of pterygium, eyelid forceps (s.v. forceps)
- Fabricius, Hieronymus, falciform fistula knife 104
- feather 262–263
- female conditions 212; occluded genitalia 82, 105, 133, 137, 223, 228; uterine growths, etc. 255; vaginal/uterine abscess/ulceration 45, 215. See also prolapse (uterine)
- fibula* (stitch) see *ankter*
- Fidenae (Italy), trepanation of hydrocephalic child 197
- file and [raspatory] 201
- fire tongs (in vivisection) 243
- fistula knife (*suringotomon*) 104
- fistula (anal): treatment of by surgery 104–106; by medication passim 313–342; for ligation of see apolinos. See also aegilops
- flaxen lint 315–317
- forceps: Hippocratic 40; Imperial 233–249 including: bone 241, caustic 246, coudée 233, 235, dentated spring 235, eyelid 238, hemostat? 245, missile 243, [obstetric] 259, pharyngeal 248, polyp 249, smooth jawed spring 234, stone 248, tooth/stump 239, uvula 243
- forgeries 5
- Forum of Peace (Rome), fire in 15
- fractures: cranial 39, 200, 235, 242; limbs 40, 202–205, 242, 294, 305–308; unspecified 336–337
- fumigation 46, 295–296
- fungi as cauteries 32, 172
- Gaius Firmius Severus, instrumentarium of (Rheims) 14; needles 75, 172; retractor 177; steelyard 269
- Gaius Marius, surgery of for varicose veins 21m19, 180
- Galen of Pergamon: on specialization 13; training 8–10; restricted view of spoon probes 129–131
- Gallatin Painter, illustration of bow drill 187n448
- gastrorrhaphia (stitching abdominal wall) 22n102, 149, 300–302, 305, 339
- Glycon, Green Plaster of 300–301
- goat (coarse sponge) 342
- goiter/choiras 51, 72, 84, 96, 121, 237n668
- Gordon, Bernard, earliest testimony to vaginal dilator? 253n725
- gouge 5, 191–197
- graves, instruments from see Künzl
- guard/protector (*meningophulax*, *enterophulax*) 190–191
- Gulf of Baratti (Tuscany): boxwood containers from 5, 276; bleeding vessel 62
- gynecology see specialization
- half spatula knife 97
- Haltern (North Rhine-Westphalia, Germany) elevator associated with Varus defeat 204
- hammer/mallet 197
- headache, treatment of: cupping 26, 63–74; bleeding 85n78, 89, 205, 314; shaving and massage 106; cauterizing 113, 162–171; clystering 213; medicating 112 (probe), 231 (insufflation) 318, 327, 346 (dressings of linen, wool)
- Heister, Lorenz: anchoring scalpel blade in slot 73n36; fistula knife 104; curette for eyes 140

- Heliodorus of Alexandria: on treating
 fistula 98, 105, 128–129, 167, 183, 249; on
 ‘Lip Guard of’ 300
hemitubion (thick linen cloth) 308
 hemorrhage (preventing/arresting):
 cupping 66–72; medication 112;
 cauterization 163–165; clystering 212;
 ligation 305–306; suppository 322, 336,
 341
 hemorrhoids, treatment of: (rectal) see
 especially 30–32, 174, 244, 246, 305, 310,
 314, 347; (uterine) 98, 237, 255
 hemostat see forceps
 Heracleides of Tarentum: creator of file 201,
 records death from tooth extraction 240,
 creator of plaster 309n61
 Herculaneum (Italy), recently recovered
 wooden case 12
 Hercules, motif on instruments 19–20,
 74–75, 156, 177
 hernia 1, 21; specialists for 13; cirsocele/
 varicocele 165, 171; inguinal/
 bubonocoele 170, 175, 343; scrotal 80,
 108; umbilical/exomphalos 152, 165, 175,
 268, 314. Et passim for all types; see also
 truss
 Heron of Alexandria: special cup and
puoulkos designed by 7, 16, 61, 102, 217;
 nomenclature of cylindrical objects 276
 Herophilus of Chalcodon: gynecological
 interests of 54, 114, 256; tooth extraction
 240
 Hippocratics: types of practice 11;
 improvisation 50; fewer surgical
 interventions 51–55
 hooks/retractors: blind/or blunt 177;
 lithotomy 181–182; sharp 173–177
 hook/retractor for removal of uterine
 accretions 259
hupaleiptron see probes
 huposphathismos 92, 97, 120, 205–207
hupotheton see suppositories
 impellent (*dioster*) 143
 instruments (surgical): adapted from other
 professions 38, 187; characteristics of
 16; depicted on reliefs and
 coins 14–15n65, 25n12, 57; design,
 materials and manufacture of 14–19;
 found in baths, rivers and at sea 5; lack
 of Hippocratic types 50; used for other
 purposes 4, 28, 50, 77, 109, 234
 instrument for freeing gums from teeth
 (*pericharacter*) 206
 instruments for stirring 291–293
ipoterion (papyrus suppository and
 plaster) 309–310
 John Chrysostom, surgery in public 8
 John of Ephesus, story of presbyter
 Aaron 223n605
 Kalkriese (Lower Saxony, Germany), elevator
 associated with Varus disaster 53
 Kallō[n], sex change 223n605
kephalike smile (knife) 92
kephalike (*emplastros*) of Philotas 10, 310
 knife for excision of uvula
 (*staphulotomon*) 103
 knives (surgical): see *amphismile-ion*?, fistula
 knife, half spatula knife, *kephalike smile*,
 lancet, lithotomy knife, raven/crow,
 phlebotome, polyp knife, pterygium
 knife, scalpels/dissectors, *skolpion*/
skolopomachairion, spatula knife, suture
 knife, tonsillotome, knife for excision of
 uvula
koparion, *hudrokelikon koparion* see probes
krokus see suppositories
 Künzler, Ernst, typology of authenticated
 tools 4
lana, lanolin see wool
 lancet 88
lemniskos see suppositories
 lenticular (chisel) 195–196
 Leon Iatrosophistes, need for hands on
 experience in surgical training 10n30
 Leonides of Alexandria, surgery for: anal
 fistula 128–129, 250–251; breast cancer
 160; hemorrhoids 244; superfluous skin
 of scrotum 198; et passim
 levers/elevators: bone Hippocratic 40,
 Imperial 202–205; periosteal 205;
 levering teeth 144, 206–207
 ligation of blood vessels 42; see also *brochos*

- linen cloth, lint, thread/cord 312–315; for types see Appendix: *hemitubion*, *linamentum*, *linteolum*, *omolinon*, *othonion*; as band/cord for ligation 306
- Lists (medieval inventories) 7–8, et passim
- lithotomy hook (*lithoulkos*) 181–182
- lithotomy knife (*lithotomon*) 98
- lithotripsy see Ammonius
- Lucian of Samosata: instrumental décor 18, 57, 74, et passim; incompetence and malpractice 111n35 & 37; shaving head with razor 200n499; shoemakers use of scalpel 77
- Lucretius, poverty of Latin terminology 6
- lunated cautery see cauteries
- Marcellus of Side, trident cautery 169
- Martial: surgical specialties 2n1, 13–14; medical rounds 8; quacks 11n35; treatment of uvula with caustic 247; ivory containers 277n839
- Marullus, Galen's treatment of slave of 22
- Meges of Sidon: design of lithotomy knife 7, 15, 101–102, 142; use of spoon probe in ligating fistula 137; use of screw probe 138; ligating fistula 305n38; use of papyrus in treating fistula 309
- mele ischure/mele traumatike* see probes
- metal plates (*elasmata*) 318–319
- Metapontum (Italy), surgical clinic 12
- Meyer-Steineg Collection: contamination of 4n5; cranioclast 43, 257; Scoop of Diocles 141–142; trocar 156; lithotomy hook 182, 259
- Michael Italicus, re *amphismile* 96
- Michael Psellus, poem of re hupospathismos 206; and uterine speculum 253n724
- midwife's chair 46n85, 260–261, 295, 305
- Milne, John Stewart (pioneer predecessor) 2–6 et passim.
- missiles (imbedded) 54, 241–243, 305; for missile forceps see forceps
- 'Moderns' vs. 'Ancients' 9, 170–171, 184n434, 307
- mortar and pestle 263–267
- motophulax* see guard/protector; as bandage 323–324
- motos* see suppositories; as Hippocratic drainage tube 47–48
- Muscio, paraphrase/translation of Soranus 105n145, 251–252, 261n762
- nasal clyster 213
- nasal polyp, treatment of: Hippocratic with sponge and loop 36, 314; with scalpel or special knife/scoop 52, 93, 97 et passim; with cautery 167n378, 171 et passim; with medication applied by probe 136–137 et passim, by insufflation 231, and with suppository 316; for specific medications, see e.g. 280–281
- needles: eyed 147; for cataract and other eye conditions 152–156; trocar? 156
- Niger (townsman of Plutarch), surgery for fishbone lodged in throat of 248n709
- obstetric forceps see S. Baglioni
- ointment Slab (Reibpalette) 267–268
- olivary enlargement (*puren*) 113–116; also see olivary cauteries 171
- omolinon* (crude linen cloth) 325
- ophthalmology: see eyes, eyelids (diseases, treatments of); specialization
- ozaena/ozaina (fetid nasal polyp) 112, 115, 136, 165, 167, 346
- pain (surgical) see anesthetics
- pannus*: as compress 317n88, 337; as truss 343n221. See *splen*
- Pantocrator Monastery in Constantinople, instrument list in constitution of 240
- papyrus 328–330
- Paul of Aegina: assistants, education/training 9–10
- penicillus-um* (as sponge) 331–332
- penis, conditions requiring surgical intervention: calloused cracks on foreskin 78, 82; adhesion of foreskin and phimosis 82–83, 95, 214; carbuncle 214; imperforate glans 82, 164; hypospadias 223; gangrenous foreskin 113, 163–165, 168, 223; growths on 81, 108, 214n567; hemorrhage 222n598; enlarging/restoring foreskin 81, 206, 312, 330
- periosteal elevator for pericranium see levers/elevators
- periskuphismos (incision around the scalp) 272, 366

- pessos* see suppositories
- Peytel (Aryballos) clinical scene 25n13
- pharyngeal forceps see forceps
- Philagrius of Epirus, use of spoon probe re bladder stone 132–138 passim 234n655
- Philo of Byzantium, nomenclature of cylindrical objects 276
- Philonicus and Demetrius, tombstone of from Frascati 189n456
- Philotas of Amphissa, *kephalike* (*emplastos*) of 10, 310
- phlebotome 84
- phlebotomy 60, 86, 271, 311, 328nn137 & 139, 337
- plasters 10, 87, 106, 120, 240, 288–310 passim, 318, 336–338 (*splenion*) 341, 345–347; see also Glycon, *kephalike* of Philotas
- Plato: on medical assistants 10n33; on drawing power of cups 59n12
- Plemmirio (near Syracuse), stick to wind a tourniquet? 272, 292–293
- Pliny the Elder: social status of physicians 13; ivy as medicine 19; linen cloth 315n83; fumigation 296; sponges 331; et passim
- plugs, pledgets see suppositories
- Poles ‘elephantine’ of 265
- polyp (nasal, treatment of): cutting and scraping 83–84, 93–95; cauterizing 32, 158n350 (veterinary) 171; forceps 235, 249; medication 136–137, 280–281; loop and sponge 36, 314. Et passim. See also ozaina
- polyp forceps see forceps
- polyp knife 93–95, 97
- Portici (Italy), Museo Reale, depository for discoveries at Herculaneum and Pompeii 2, 248
- Pournaropoulos, K. G., Greek sources for surgery 3n4
- Probes: Hippocratic 33, Imperial 110–113 including: anchor 139; with two olivary enlargements (*dipyrene*) 116; eye 139; eyed (see apolinosis); *hupaleiptron* 125; *koparion* 123–125; screw 138; simple 110; spatula 118–122; spoon (‘cyathiscomele’) 125–138; wound 141; see also *amphimele/amphimelon*, olivary enlargement
- prolapse: anal/rectal 85 (veterinary) 171, 318; intestinal 105, 339, 343; uterine 46, 230, 295–296, 341, 347, et passim
- prostheton* see suppositories
- pterygium: (of eye): 91; knife for excision of 91–92; hook to raise 174; post surgical medication of 315, 346; (of nails) 124, 164. Et passim
- ptugma* (compress, dressing) 334–336; see also *motophulax*
- Publius Aelius Pius Curtianus, tombstone from Palestrina 17
- puoulkos* or pus extractor 217–218
- Pydna (Greece), new instrumentarium 25n10, 26n14, 50n102, 62
- Quintilius Varus, disaster in Teutoburg forest 53, 204
- raven/crow (knife) 87
- razor 106; see also cauteries
- Rimini, Domus ‘del chirurgo’ 5, 14; instruments recovered in: scalpels and knives 74–75, 90, 103; Scoop of Diocles 142; bow drills 189; chisels/gouges/lenticulars 191–196; file 201; forceps 233–244; mortars and pestles 267; glass puddles 278n848
- ring knife for dismembering impacted fetus 255
- rods for hernia, bone and eye work 268–269
- Rueff, Jacob/James, association with worm-driven trivalve speculum 253
- Rufus of Ephesus: analgesic 21; cup like womb 56; lithotome 99; on shape of male catheter 221
- Sacred Way (Rome): fire along 15; Gaitanian linen sold along 306
- Sargent’s Drug Store (Chicago), re leaches 61n23
- Savenko, Pyotor, drawings by 2n3; 248
- saw 38, 183–184
- scale, steelyard 269
- scalpels and dissectors: Hippocratic 27–30; Imperial 72–84; used by shoemakers 77
- Scoop of Diocles see Diocles of Carystus

- screw probe see probes, Meges of Sidon
- Scribonius Largus: career 8; on amateur practitioners 11; on gastrorrhaphia 300–301; on probes 135; toothache 200
- Scultetus, J., on uterine speculum 253n725
- sharp hook see hooks/retractors
- sieve/strainer 269–271
- skolopion/skolopomachairion* (surgical knife) 92
- smiths, instrument manufacture and care 15–16, 31, 73
- Soranus of Ephesus, on embryotomy 257–259
- spatula see cauteries and probes; for stirring 288, 291–292
- spatula knife (*spathion*) 96
- specialization 13–14, 100
- speculum: Hippocratic? 48; Imperial (rectal, uterine) 249–255
- spheniskos* see wedge
- spindle hook 271
- splen* (compress, pad) 336–337
- splenion* (compress or plaster) 337–339
- splints: gutter type 306–307; fennel stalk as 308
- sponge 339–343; see also *penicillus-um*
- spoons: simple 144; for application of gargle to uvula 146; see also probes
- St. Thecla, life of 153n321
- Stanway (Essex, GB), new instrumentarium: iron/steel instruments 17n71; local variation 55n11; Celtic influence 184n432
- Stephanus of Athens: training/education 9–10; use of fingers for forceps 233
- stirring, instruments for 291–293
- strigil, used as uterine curette 39–40, 261
- stylet for opening the cranium of impacted fetus 255–257
- stylus 143–144; as cautery 167; fashioned into retractor 177; in tooth extraction 207
- suppositories: *balanos* 302–304; *hupotheton* 309; *krokus* 310–312; *lemniskos* 312; *motos/diamotos* 319–323; *pessos* 332–333; *prostheton* 334; see also wool
- surgeons: training and practice 8–13; social status of 13
- surgery, success rate 20–22
- suture knife 90
- sutures, stitches, knots 52, 90, 148–149, 313n76; see also *anker*
- syringes see ear clyster/syringe and *puoulkos* or pus extractor
- tattoos, removal of 150, 162n368
- Tenon, Jean Claude, early drawings of instruments at Portici see Védrenes
- Tertullian, on surgical abortion 44, 255–260
- Theban (a type of mortar) 264
- Timocrates, tooth powder of 292
- tongue depressor 123
- tonsillotome, tonsillectomy 102
- tooth/stump forceps see forceps
- toothache, relief of by: cupping 63; medicated probe 135; stimulation of cheek with strigil 147; cautery 167; drill 188; scraping away decay 200
- tourniquet 271–272
- training of surgeons 8–11
- trepanning, trephining see drills
- trichiasis, ophthalmia: see eyes, eyelids (diseases, treatments of); suture knife; et passim
- trocár see needles
- truss: for broken jaw 317; for hernia 343; see *boubonophulax*, *fascia*
- tubes: bellows and bladder 229; *cannula* 224; catheter 220; as guard for cautery 229; insufflator 231; to prevent contractions and adhesions 226; to prevent hemorrhage 233; as a straw 232; see also cauteries for tube as cautery; clystering, douching; clyster tubes; syringes
- urology see specialization
- uterine clyster see clysters
- uvulectomy 13, 103, 243–245
- uvula forceps see forceps
- varicose veins: 1, 124–125; treatment of by: burning 165; exposing, evacuating 305; excising, incising 81, 84, 175–176; extracting (see varix extractor); levering 117, 178; ligating 152; post surgical plaster for 338

- varix extractor 173, 180–182
- Védrènes, A., drawings in edition of
Celsus 2n3, 36n46, 95n108, 140, 216n572,
248n710
- vessels, multipurpose 278–285; see also
basins/tubs, boxes for storage, cooking
pots
- Vidus Vidius, Renaissance *motophulax* and
lenticular 191n463, 196n486
- Vulpes, Benedetto, lectures by 2–4, 253n725
- warming devices 297
- wedge/stake: for reduction 205; for
stabilization 272–273; a suppository
336; cauteries in shape of wedge 31–32,
168
- wool (cloth, carded, suppositories,
lanolin) 343–347

Greek Index

- ἀγγεῖον 281–283
 ἀγκιστρον 173–177 et passim
 ἀγκτήρ 299–302
 ἀγκυλοτόμον 102
 ἀγκυρομήλη 139
 ἀθερολόγιον 234
 αἰγίλωπικὸν καυτήριον 172
 αἰμορροῖδοκαύστης 246
 ἀκανθοβόλος, ἀκανθολαβίς 248
 ἀκίς 30, 147
 ἀκμή/αἰχμή 186
 ἀκόννη 268
 ἄκρον (point/tip) 28, 33, 45, 129–130, 148, 158, 186, 204; (mouth of gourd) 46
 ἀμφιμήλη, ἀμφιμήλον 117
 ἀμφισμίλη, ἀμφισμίλον 95–96
 ἀναβολεὺς 202–203
 ἀναρραφικὸν (σμιλίον) 90
 ἀντιβολάδιον 203
 ἀντιοτόμον 102
 ἀντόπτρα 252
 ἀπολίνωσις 34, 105, 117–118, 124, 136–138, 306, 325
 ἀρίς 187
 ἄσκος, ἄσκωμα 208
 ἀσπιδίσκη, *aspidiscus* 209
 ἄτρακτος 36–37
 αὐλίσκος 7, (as cautery and for inflation) 47, (guard in cauterizing) 167, (clyster) 208, (catheter) 220, (preventing contractions and adhesions) 227, (wedge) 272, (fumigation) 295 et passim
 αὐλός 45–47, 213
 βάλανος, βαλάνιον, βαλανίς 302–304
 βελόνη 30, 147
 βελουλικός 243
 βίχος 283–284
 βλεφαροκάτοχον (μυδίον) 238
 βλεφαροξύστον 139
 βουβωνοφύλαξ 343
 βρόχος 305–306
 γάστρα 291
 γλαύκωμα 152
 γλωσσοκάτοχος 123
 γλωσσόκομος-ον 307
 γομφωτήρ 192
 γραμμιστήρ 144
 γραφεῖον 144
 δέλτος, δελτάριον 276–278
 διάμοτον 319, 322
 διαστέλλουσα/διαστωμοτρίς, see μήλη
 διαστολεὺς 252
 διατρήμα 148
 δίοπτρα 251–252
 διόπτριον 249
 διπύρηνον 116–118
 δίφρος μαιωτικός 260, 295
 διωστήρ 143
 δοῖδυξ 263–264
 δρεπανοειδὲς ὄργανον 104n143
 ἐγχειρίδιον ἱατρικὸν 276–278
 ἐδροδιαστολεὺς 249–251
 ἐθειρολόγος 234
 ἐκκοπεὺς 191–194
 ἐκκοπεὺς κυκλίσκος, κοιλός, φακωτὸς 194–196
 ἔλασμα-ατα (blade/shaft) 77, 95, (block/director) 129, (*dipyrene*) 116, (parts of probe) 109, 121, (pestle) 263n771, (metal plate) 318–319, (valves of speculum) 252
 ἔλκυστήρ 43, 52
 ἐμβρυοθλάσσης 257
 ἐμβρυοσφάκτης 256
 ἐμβρυοστόμον 256
 ἐμβρυουλκός 257
 ἐνετήρ 208
 ἐντε<ρο>φύλαξ 7, 191
 ἐξοχαί 186
 ἐξωτίς 126, 130
 ἐπίκοπον 197–199
 ἐπικρουστικόν, ἐπικρούστιον 86–87, 197n488
 ἐργαλεῖον λογχητικόν 88–89
 ἔριον (πιναρόν, ῥυπαρόν, οἰστυπηρόν) 344
 ἥθμός 269–270
 ἡμισπάθιον 97–98, 105
 ἡμιτύβιον 308

- θλάστης 43
 θυία, θυεία 263–267
 ἴγδιον, ἴγδις 263–266
 ἰπωτήριον 309
 ἴσκαι, ἴσχει 172
 ἴτυς 186
 ἰχθύη 43n74, 255
 καθετήρ, καθετήριον/καθετήρ
 ὄργανον 220–224
 καθετήριον σύριγξ 220
 κακ(κ)άβη-ος, κακκάβιον 285–286
 καλαμίσκος (container) 46n84, 275, 277,
 (tube) 224, 226
 κάλαμος 46, 231, 295
 καρκίνος ἱατρικός 28n18, 41
 κατιάς, κατιάδιον 88–89, 92, 257
 κατοπτήρ 133, 148–149, 249–251
 κάτοπτρον 49n100, 133
 καυλοκλυστήρ 219
 καυστήρ, καυστήριον 31, 47, 164
 καυτήρ, καυτήριον 31, 158–165
 κεφαλικὴ (ἔμπλαστρος) 310–312
 κεφαλοτρύπανον 186
 κισσουλάκος 180–181
 κλυστήρ, κλυστηρίδιον 208–214, 220
 κοπάριον 123–125
 κοσκίνον 269–270, 280n855
 κοχλία/κοχλίας 252
 κοχλιάριον 144–145
 κρίβανος/κλίβανος 282
 κροκύς 310–312
 κυαθίσκος 127–140
 κύαθος 56n2, 127
 κύαρ 147
 κυλίχης, κυλίχην, κυλίχινον 24, 284–285
cystophilos 220, 224
 λαβή (handle) 77, 80, 158, 192; (hook/
 retractor) 99, 182
 λαβίς (forceps) 41, 234; (dissector/handle)
 77
 λέβης 290, 296
 λεκάνη, λεκάνιον 293–295
 ληνίσκος 312
 λιθαναβολεύς 259
 λιθολάβος 183
 λιθοτόμον 98–100, 133, 182
 λιθουλκός 181–183
 λίνον 312–315
 λοπάς, λοπάδιον 287–290
 λωτός 252
 μασχαλολαβεύς 249
 μάχαιρα, μαχαίρις 27–28, 76
 μήλη 7, 33–38, 109–112 et passim, μήλη
 διαστελλουσα/διαστωμοτρίς 36, 141, μήλη
 δίκρους 36n48, μήλη ἰσχυρή
 (= τραυματική μήλη) 141
 μηλωτής, μηλωτρίς 37, 126–138
 μηνιγγοφύλαξ 190–191
 μηνοειδὲς καυτήριον 168
 μητρυνύκτης 252
 μικρόν διόπτριον 48, 249, 252
 μοτός, μότα/μοτά, μοτάριον (metal tube)
 47–48, (suppository) 319–323
 μοτοφύλαξ, μοτοφυλάκιον 323–324
 μοχλός, μοχλίσκος 40, 202–205
 μύδιον 235–238, 244
 μυδιόσκελλον 235
 νάρθηξ, νάρθηκιον (container) 276–278,
 (splint) 308
 ξυστήρ, ξυστήριον (curette) 39, 261
 ξύστρα 44, 146
 ὀδοντάγρα 41, 239, 240–242
 ὀδοντοξυστήρ, ὀδοντοξέστης 200
 ὀθόνη, ὀθόνιον 326–328
 ὄλμος 263–265
 ὄνυξ 44, 255, 258n752
 ὄξυβελές (ὄργανον) 89
 ὄξυλαβίδιον 234
 ὀρθοπρίων 38
 ὀσταναβολεύς 203
 ὀσταναλαβεύς, ὀσταναλαβίς 203n512, 242
 ὀστεγχύτης 220
 οὖς 147
 ὀφθαλμική μήλη 34, 121, 127, 140
 ὀφθαλμοστάτης 238
 πάπυρος 329nn142 & 143
 παρακεντήριον 153
 παρέξοδος 24

- περιζυστήρ, περιζύστης 199–200
 περιχαρακτήρ, περιχαρακτήριον 206–207
 πεσσός, πεσσάριον 332–334
 πίεστρον 43
 πιθάκη 291
 πλάστιγγ 269
 πλευροπιστήρ 7, 183
 πολυπικόν σπαθίον 93–97, 256
 πολυ<πο>σφάκτης, πολυποξύστην 94
 πολυποτόμον σπαθίον 93
 πριαπίσκος 252
 πρίων 38, (ὀδοντωτός, μαχαιρωτός) 183–4
 προσθετόν (φάρμακον) 334
 πτερόν 262n766, 263n767
 πτύγμα, πτυγμάτιον, προσπτυγμάτιον,
 πτυκτον 334–336
 πύελος 293–294
 πυξίς ιατρική 276–277
 πυουλικός 217–219 et passim
 πυράγρα 243
 πυρήν 113–116 et passim
 ῥάβδος (Hippocratic probe) 36–37,
 (cautery) 158n349, (stirring rod) 292
 ῥαφίς/-ιον 147
 ῥιζάγρα 52, 131n253, 241, 243, 245
 ῥινεγχύτης 213
 ῥίνη, ῥινάριον, ῥνίον 201
 ῥινοσπάθιον 93
 σαρκολάβος-ον, σαρκολαβίς 237
 σιδήριον (cautery) 31, 158, (knife) 76,
 (lever) 40, 202
 σίδηρος-ον (general) 41n67, (cautery) 158,
 162, (knife) 28, 76
 σικύα 25–27, 56–72
 σίφων 211, 222n597, 225–226, 231–232, 296
 σκάφη 293
 σκευός, σκευάριον 279–281
 σκολόπιον, σκολοπομαχάριον 92
 σμίλη, σμιλίον, σμιλάριον 7, 28, 75–85, 92
 σπάθη, σπάθα (knife) 97, (spatula)
 122–123, 288, 291–292
 σπαθίον (as special knife) 89, 96–97, 256,
 (as πολυπικόν σπ. 97), (as ὑποσπαθιστήρ)
 97, 206n524, (as spatula) 122
 σπαθίον συριγγοτόμον 105
 σπαθομήλη 118–122 et passim
 σπείρα 281
 σπλήν 336
 σπληνίον, σπληνάριον 337–339
 σπόγγοι 339–343
 σταφυλόαγρα 41, 243–245
 σταφυλεπάρτης 146, 247
 σταφυλοκάτοχον 244
 σταφυλοκαύστης 246–247
 σταφυλολαβίς 244
 σταφυλοτόμον 103
 στλεγγίς 44
 στοματοδιαστολεύς 272
 συριγγιακόν δρέπανον 104–105
 συριγγοτόμον 104–105
 σύριγξ, συρίγγιον (catheter) 220, (shaft of
 feather) 45, 226, 262, (tube) 32, 231
 σφηνάριον πρίνινον 272
 σφηνίσκος (suppository) 336, (dilator)
 272–273
 σφύρα 197
 σχαστήριον 186
 σωλήν (splint) 306–307, (tube) 227
 σωληνάριον 223, 227, 228nn628 & 633,
 309n62
 σωληνίδιον 223, 227, 330
 σωλήνιον 295
 ταινία, ταινίδιον 271–272
 τελαμών (tourniquet) 271–272, (band,
 bandage) 300, 343
 τέρετρον 186
 τεύχος 283
 τρήμα 147
 τριχολαβίς, τριχολάβον, τριχολάβιον 234
 τρύπανον, τρυπάνιον, τρυπάνη 186, (λεπτόν)
 188
 τυφλάγκιστρον 177–180
 ὑδροκηλικόν (κοπάριον) 123–125
 ὑπάλειπτρον 32–38, 125
 ὑπερος 263
 ὑπογραφίς 144
 ὑπόθετον 309
 ὑποσπαθισμός, ὑποσπαθιστήρ 7, 92, 97, 206
 ὑπόχυμα 152
 φακωτά πυριατήρια 297
 φακωτὸς ἔκκοπεύς 195–196

φλεβοτόμον 7, 28, 84–89, 91, 93, 124
φυσάριον 208

χαλκευτική φύσα 47
χοινικίς 185–186
χύτρα/κύθρα 286, 295

ψαλίς 107

ώμολινον 325
ώτεγχύτης, ώτικὸς κλυστήρ, ώτικὸς ἐγχυτήρ,
ώτικὸν κλυστηρίδιον 214–217
ώτογλυφίς 126
ώτολαβίς 249

Latin Index

acus 147–148, 153, *tenuis a. ferrea*
156, 301

aeneum spiculum 256–257

ampulla 284

anuloculter 44

auliscus fysarius 208

auriscalpium 134–138, 344n225

baca/bacula 113, 134n264

canalis 306–307

cannula 207, (d'osso) 212, 224–229, 231 et
passim

cauteres serrati 169

cauterium plumbeum . . . quadratum
158n340

cefaloclases 257

chirurgus 21, *chirurgus venarius* 13

collyrium (eye salve) 232, (suppository)
302, *collyrium suppositorium* 309

corvus(os) 87

cos 268

cribrum/cribellum 269

cucurbita 56

cuneus 272

cyathiscus Diocleus 141

dentiducum (instrumentum) dentharpaga
240

dolium/doliolum 284

faber 73, 205

fascia 307

ferrum/ferramentum-a 6, 84, *f. acuto modo*

spathae factum 84, *f. ad similitudinem . . .*

Graecae litterae 49n97, 251, *f. fecit*

(*Meges*) *rectum* 101, *ferrum/ferramentum*

candens 53, *f. candens et igneus* 161, 165,

cyathisco f. 134n262, *leptospathio f.*

344n225, *f. quod a similitudine coruom*

uocant 80n70, *f. pleni acuminis* 79n66,

tenui ferramento . . . spathae

simile 166n372

ferula 308

fibula 299–302

fictilis fistula 167

fistula, plumbea aut aenea 224, 225n615

folliculus 208, 220

forceps (pliers-like forceps) 236 & 240

forfex (shears) 107, (pliers-like forceps)
236 & 240

habena 187

hamus, hamulus, h. (retusus) 173

lana 343–347 et passim

laureolus/um 137n272

lignei fungi 172

ligula 130–131, 145, 159, 166, 171 et passim

lima 201–202

linamentum 315–317

linteolum 315, 317–318

linum 306, 313–314, 316

malleus-um 197

manubriolum 52, 77, 84

medicatissima (hedera) 19

medicus ocularius, m. chirurgicus 13

membranae custos 190

ministeres 10n32

modiolus 185, 188

mortarium 263, 266

mucro 79–80, 142, 173, 186

myzon 235

novacula 106

olla 285–287

oricularium specillum 135, 138

oricularius chyster, chyster auricularis 53,
214–215, 220

oticus auliscus 214, 216

pannus 317, 336–337, 343

patella, patina 289–290, 292n935

pagillus tenuis 205

penicillus-um 331–333

pila 263–266

- pistillus-um, pilum* 263
principium 114, 134n264

regula 268–269
rizagra 241

sagitta 79n66
scalpellus 76, 83–84 et passim, *scalpellus*
crassi acuminis 79n66
scalper/scalprum 76, 121, 199, *scalper*
excissorius 191n466, 195; *scalprum*
planum 191n466
scriptorius calamus 167
scutra 295–296
sella pertusa 295–296
serrula 183–184
solium 294
spatha 122, 291–292; see also
ferramentum
spathomele /spatomelle 119
spatula 291

specillum 112–113 et passim, *asperatum*
sp. 139, *sp. oricularium* 52–53, 134–135
speculum magnum matricis 253n725
spongea 339
strigilis 147
suffusio 152

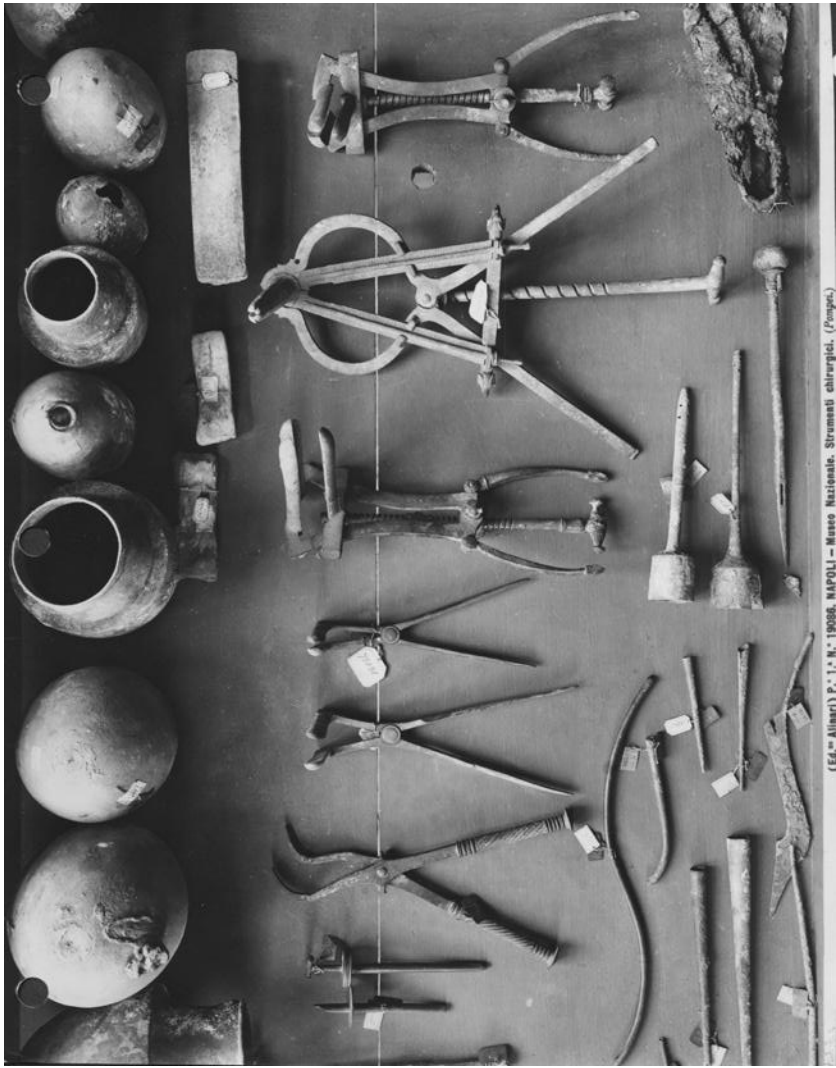
tabella 308
terebra 185
theca 276–277
tibia 208, 210n548
tornus 18
tortili temperamento 252n722

unco ferramento 94
uncus 52, 99, 182, 192, 258

vas/vasculum 284, 297
ventosa (cucurbita) 56n1
volsella, vulsella 234–236, 240–241
volsella quali fabri utuntur 205

Figures





(Ed. = Alinari) P. 1. N. 1908. NAPOLI - Museo Nazionale. Strumenti chirurgici. (Pag. 1.)

FIGURE 1 Alinari Photo, no. 19086. Instruments from Vesuvian Cities, Naples Museum. Late nineteenth century.

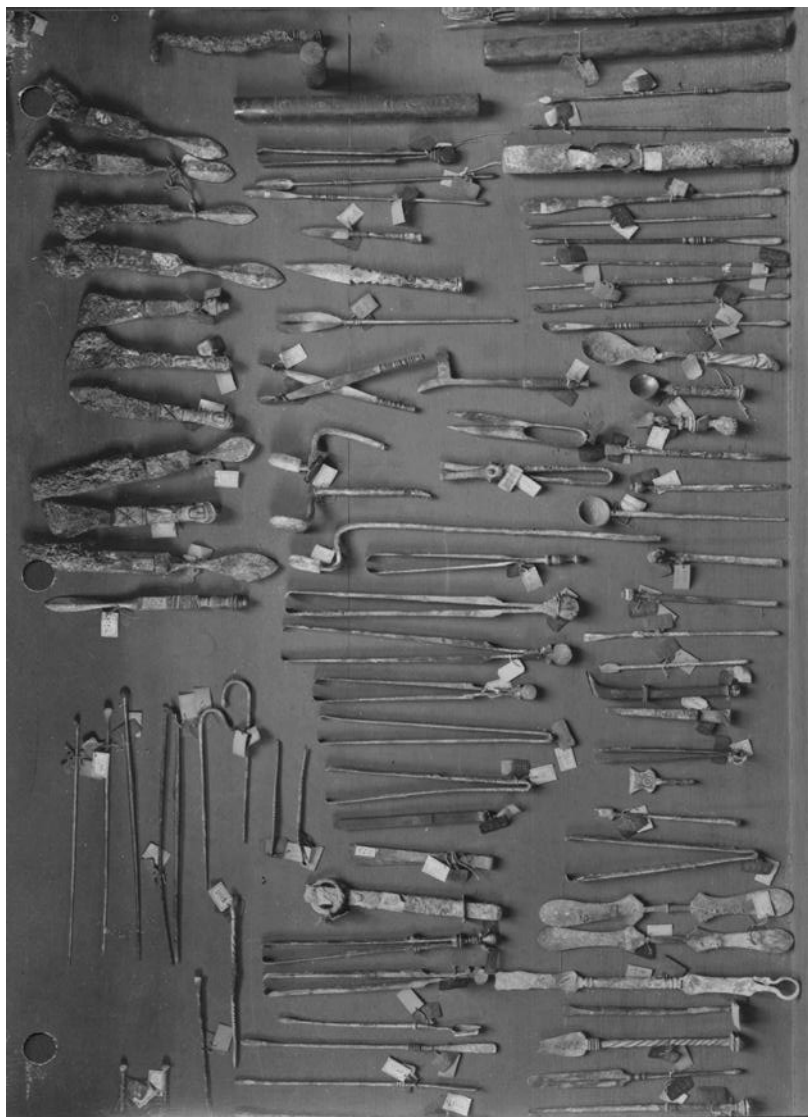


FIGURE 2 Alinari Photo, no. 19087. Instruments from Vesuvian Cities, Naples Museum. Late nineteenth century.

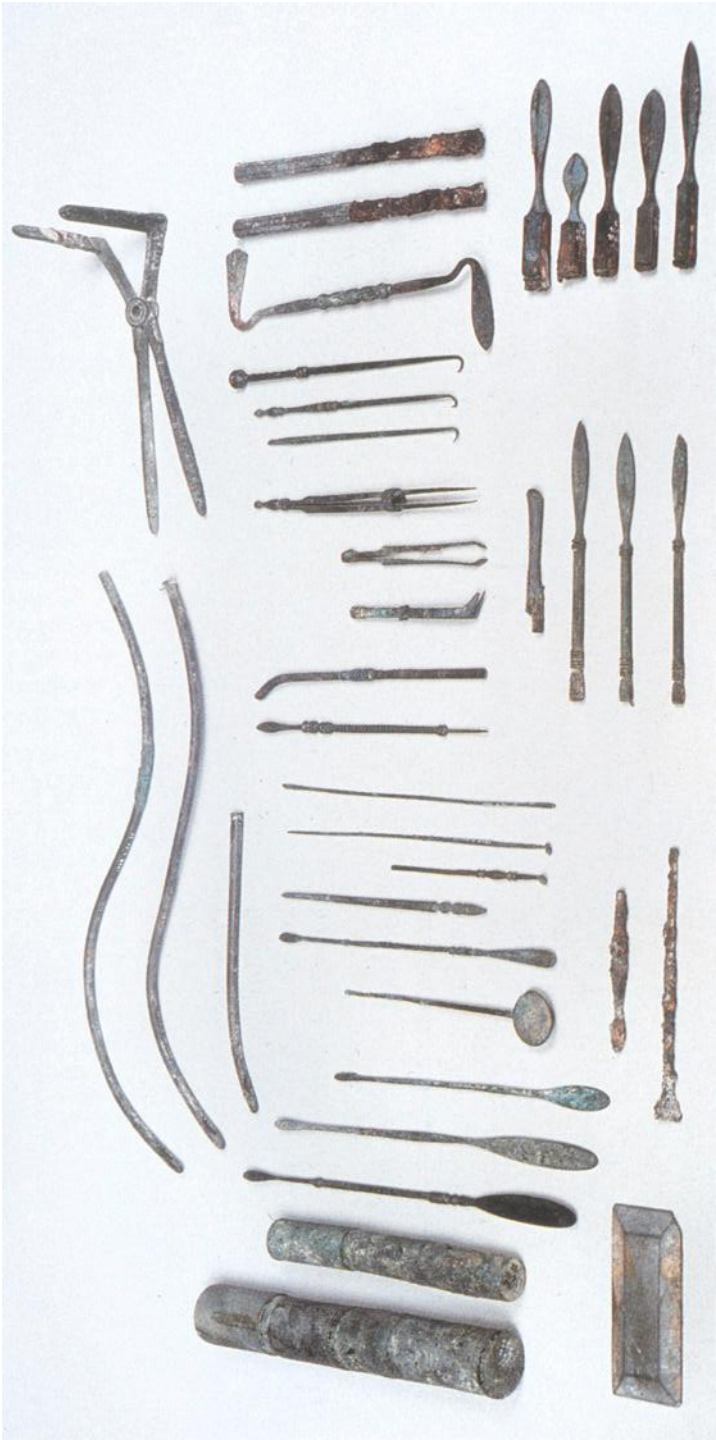


FIGURE 3 *Instrumentarium from Italy, British Mus.: Length of longest catheter 30.25 cm. 1st–early 2nd century CE.*



FIGURE 4 *Cupping Vessel, Corinth: Nat. Arch. Mus., Athens, Inv. L349b: Ht. 9.1 cm. Ca. 500 BCE.*



FIGURE 5 *Cupping Vessel, Thebes: Nat. Arch. Mus., Athens, Inv. L349a: Ht. 14.8 cm. Ca. 500 BCE.*



FIGURE 6 *Cupping Vessel, Tanagra: Nat. Arch. Mus., Athens, Inv. 7596: Ht. 14.8 cm. Traditionally dated 500 BCE but probably Hellenistic.*



FIGURE 7 *Cupping Vessels, Pompeii: Nat. Arch. Mus., Naples, Inv. 77998, 77989: Ht. of largest 14.8 cm.*



FIGURE 8 *Post Classical Cupping Vessels: University Museums, U. of Mississippi, Inv. 77.3.872, 870, 871: Ht. of largest 5 cm.*



FIGURE 9 *Bellied or "D" Type Scalpels, Pompeii: Nat. Arch. Mus., Naples, Inv. 116447A, 77637: L. of longest 15 cm.*



FIGURE 10 *Scalpel Handles (one perhaps with blade of "Crow/Raven" Type), Pompeii: Nat. Arch. Mus., Naples, Inv. 77679, 77681, 77684: L. of "Crow/Raven" 17.1 cm.*

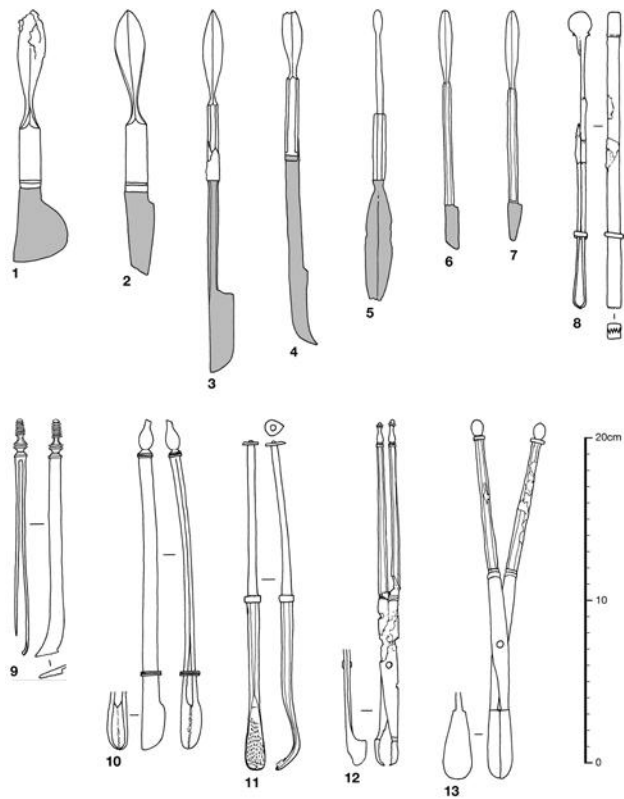


FIGURE 11 Scalpel, Forceps and Retractor Types: Domus “del chirurgo” at Rimini. 3rd cent. CE.



FIGURE 12 Scalpel Handles, probably Pompeii: Nat. Arch. Mus., Naples, Inv. currently 77846 (actual number lost), 122938, 77673: L. of longest 8.5 cm.



FIGURE 13 *Scalpel Handle, "Hercules Type", Pompeii: Nat. Arch. Mus., Naples, Inv. 77694: L. 7 cm.*

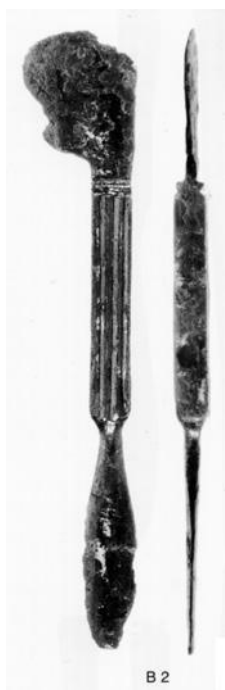


FIGURE 14 *Scalpel with Handle of Fluted Pilaster Type, Asia Minor: Römisch-Germanisches Zentralmuseum, Mainz, Inv. 0.38209: L. 13.3 cm. 1st–2nd cent. CE.*



FIGURE 15 *Scalpel Handle with Ivy Pattern Damascened in Silver and Copper, Asia Minor: Römisch-Germanisches Zentralmuseum, Mainz, Inv. 0.38191: L. 9 cm. 2nd cent. CE.*



FIGURE 16 *Phlebotome (likely veterinary), Pompeii (VI 1, 9–10.23 = House of the Surgeon): Nat. Arch. Mus., Naples, Inv. 78007: L. 11.7 cm.*

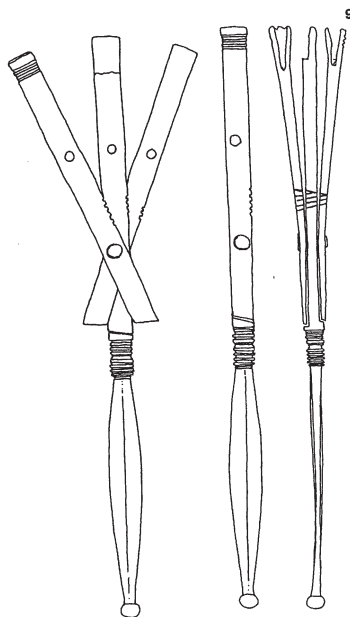


FIGURE 17 *Three Bladed Phlebotome?: Rome: Museo Nazionale Romano, Inv. 65758, L. 16.9 cm.*



FIGURE 18 *Lancet-like Spatula (perhaps also serving as a lancet): Welch Medical Library, Johns Hopkins Univ. Institute of the History of Medicine, Baltimore: L. 13.3 cm.*

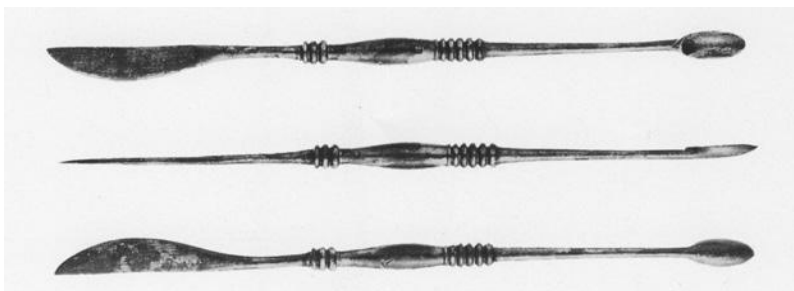


FIGURE 19A *Knife with Spoon: allegedly Ephesus: Jena, Friedrich-Schiller-Universität. Institut für Geschichte der Medizin, Naturwissenschaft und Technik (Ernst-Haekel-Haus), Inv. 30: L. 11.5 cm.*



FIGURE 19B *Spatula with Spoon: allegedly Ephesus: Jena, Friedrich-Schiller-Universität. Institut für Geschichte der Medizin, Naturwissenschaft und Technik (Ernst-Haekel-Haus), Inv. 49: L. 18.5 cm.*



FIGURE 20 *Portion of Instrumentarium allegedly from Ephesus, Römisch-Germanisches Zentralmuseum, Mainz, Inv. 0.37829-34, 0.37839-44, 0.37850. Left-Rt.: three sharp retractors, sharp retractor converted from stylus, double needle, spatula probe, lancet-cautery, three spoon probes (two with roughened interiors), two-prong stone retractor, and two lithotomy knives. Retractor at far left is longest item at 17.4 cm.; retractor 4th from left shortest at 8.1 cm. 1st half, 3rd century CE.*



FIGURE 21 *Relief now in Berlin; Candidate for Lithotomon of Meges 3rd from Left.*

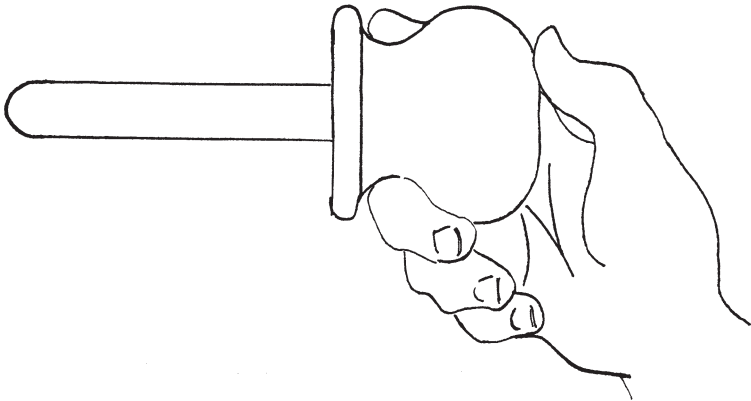


FIGURE 22 *The Milne-Daremborg Version of Meges' Lithotomon.*

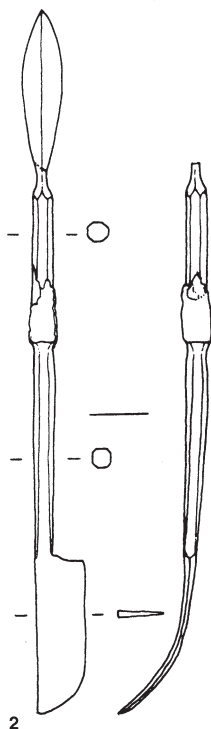


FIGURE 23 *Tonsil Knives: Domus "del chirurgo" at Rimini, 3rd cent. CE.*



FIGURE 24 *Bow Shears, Pompeii: Nat. Arch. Mus., Naples, Inv. 78005; L. 9.8 cm.*

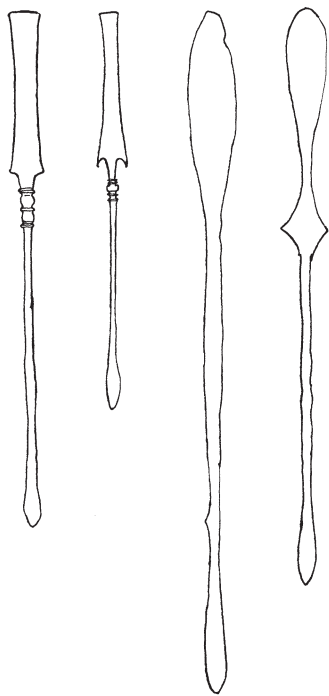


FIGURE 25 *Basic Spatula Types (rectangular, swallowtail, oval, fish), 1st century CE.*



FIGURE 26 *Spatula Types, Pompeii (lancet/spear-like) Inv. 77719, 115646: L. 14–13.8 cm.*

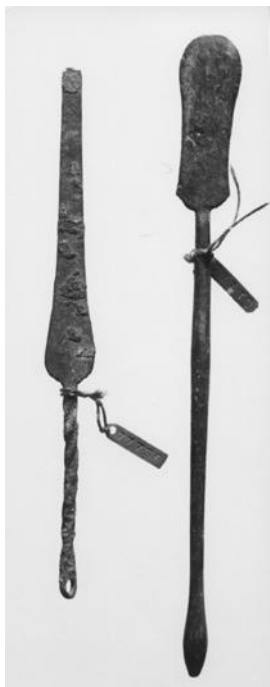


FIGURE 27 *Spatula Types, Pompeii: Nat. Arch. Mus., Naples, Inv. 77730, 77736: L. 17.3–14.3 cm.*



FIGURE 28 *Large Double Spatula Types, Pompeii: Nat. Arch. Mus., Naples, Inv. 77733, 77732, 77734: L. 17.3–17 cm.*



FIGURE 29 *Portion of Instrumentarium allegedly from Ephesus, Römisch-Germanisches Zentralmuseum, Mainz, Inv. 0.37830, 0.37835–38, 0.37847–49, 0.37851–61. Left–rt.: (19–22) four small scalpel handles (19–21 octagonal in section), (28–29) two medicine or instrument containers, (27) stylus, (26) small spatula, (25) fragmentary spatula, (24) small ear probe, (23) small needle/probe, (18) lithotomy knife, (30–35) six ear probe/ligula types, (36) dipyrene probe. Lithotomy knife longest item at 16.9 cm, fragmentary spatula shortest at 2.5 cm. 1st half, 3rd century CE.*



FIGURE 30 *Ophthalmic Needles with Container, Dredged from River Saône (Montbellet), now in Musée Greuze, Tournus (France): L. of container without lid 18 cm.; L. of longest needle 16.5 cm.*

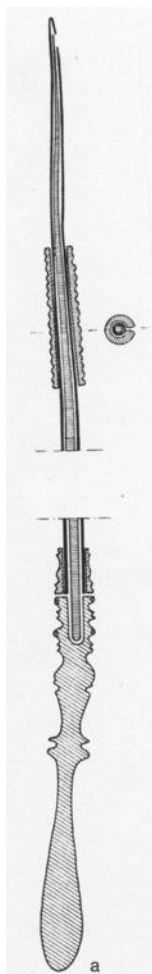


FIGURE 31 *Interior View of Ophthalmic Needle with Retractable Stem, now in Musée Greuze, Tournus (France): L. 13.5 cm.*

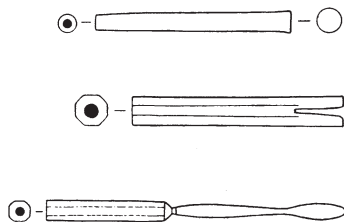


FIGURE 32 *Ophthalmic Needles/Knives, Gaius Firmius Severus Instrumentarium, Rheims: Musée d'Archéologie nationale, Saint-Germain-en-Laye: L. 8–6.2 cm. Late 2nd–early 3rd century CE.*



1

FIGURE 33 *Forceps—Needle Holder Combination, Melos: Nat. Arch. Mus., Athens. Inv. L 102: L. 14 cm. Early Empire.*

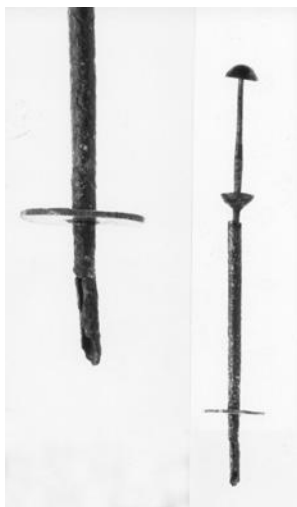


FIGURE 34 *Trocar?: allegedly from Ephesus: Meyer Steineg Collection. Jena, Friedrich-Schiller-Universität. Institut für Geschichte der Medizin, Naturwissenschaft und Technik (Ernst-Haekel-Haus), Inv. 31: L. 12.7 cm.*



FIGURE 35 *Cautery: allegedly from Colophon, Johns Hopkins Archaeological Museum, Inv. Buckler 16; L. 16.8 cm. 1st–2nd cent. CE.*



FIGURE 36 *Lunated Cautery: Museum am Strom, Bingen-am-Rhein. L. 9.5 cm. 1st half, 2nd cent. CE.*

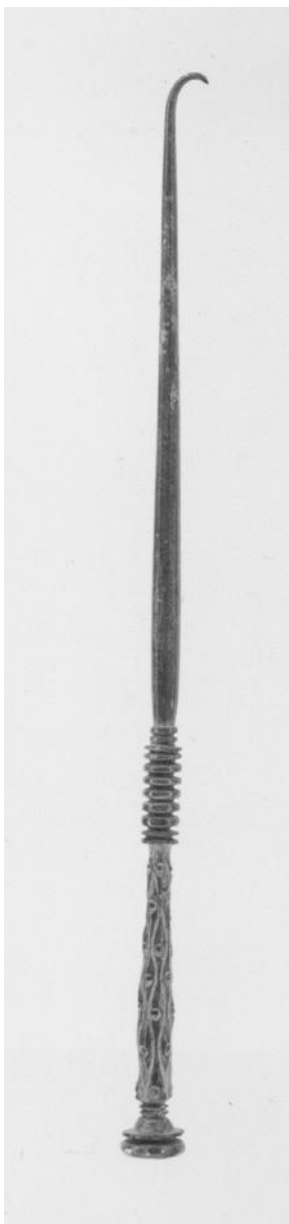


FIGURE 37 *Sharp Retractor: Indiana University Art Museum, Bloomington, Burton Y. Berry Collection, Inv. 76.34.44 u.*



FIGURE 38 *Instruments Recovered at Aschersleben Including: (1) sharp retractor, (2) lever forceps combination, (3) knife or chisel, (4) lever with slot for another lever or blade, and (5–6) two fragments, one a grip. Aschersleben, Kreismuseum, Inv. 777–782: L. 17.4 (retractor)—5.1 (fragmentary grip). Perhaps 3rd cent. CE.*



FIGURE 39 *Double Retractor: allegedly from Colophon: Johns Hopkins Archaeological Museum, Inv. Buckler 25: L. 16.5 cm. 1st–2nd cent. CE.*



FIGURE 40 *Blunt Retractor: allegedly from Colophon: Johns Hopkins Archaeological Museum, Inv. Buckler 28: L. 11.6 cm. 1st–2nd cent. CE.*



FIGURE 41 *Probable Retractor for Bladder Stone, Provenience Unknown: Cambridge Museum of Classical Archaeology, Inv. 176: L. 8.5 cm.*

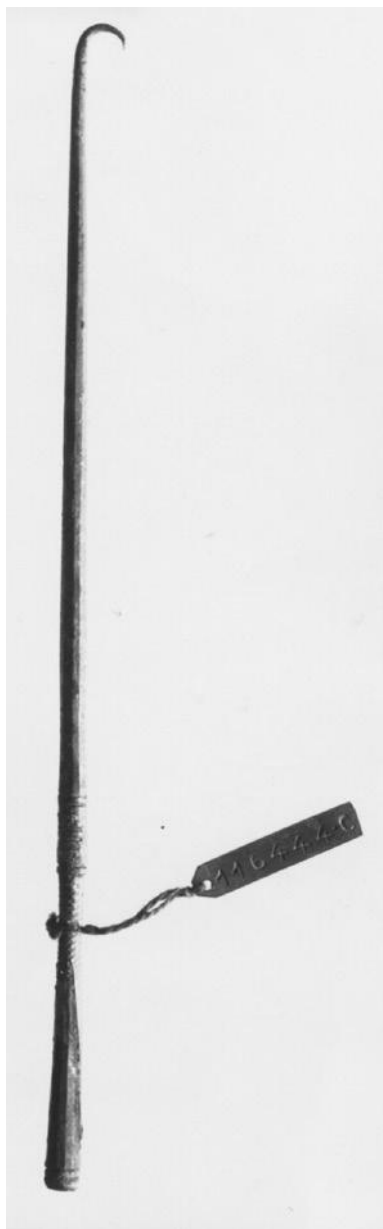


FIGURE 42 *Sharp Retractor-Needle Holder, Pompeii (IX 9, 3-5 = Casa del Medico Nuovo (II): Nat. Arch. Mus., Naples, Inv. 116444C: L. 14.4 cm.*



FIGURE 43A *Scoop of Diocles? Domus "del chirurgo" at Rimini: L. 11 cm. 3rd cent. CE.*



FIGURE 43B *Scoop of Diocles? (profile view).*



FIGURE 44 *Meyer Steineg's Candidate for the Scoop of Diocles: Jena, Friedrich-Schiller-Universität. Institut für Geschichte der Medizin, Naturwissenschaft und Technik (Ernst-Haekel-Haus), Inv. 28: L. 18.6 cm.*

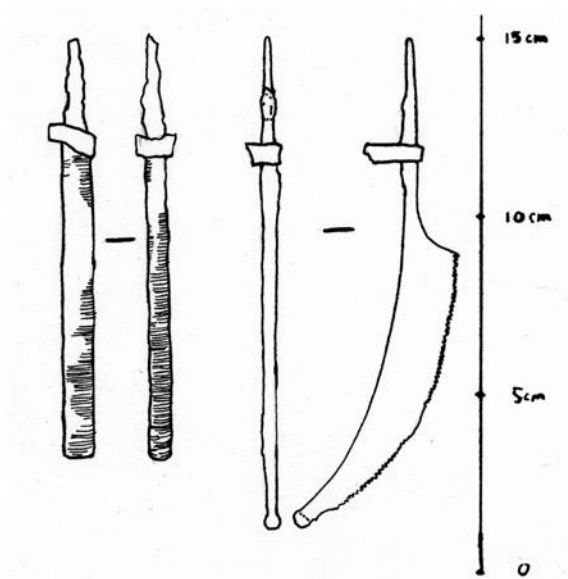


FIGURE 45 *Instruments for Bone Surgery: file and saw: Domus "del chirurgo" at Rimini. 3rd cent. CE.*



FIGURE 46 *Extended Bow Drill, allegedly from Colophon: Johns Hopkins Archaeological Museum, Inv. Buckler 15: L. 39 cm. 1st–2nd cent. CE.*

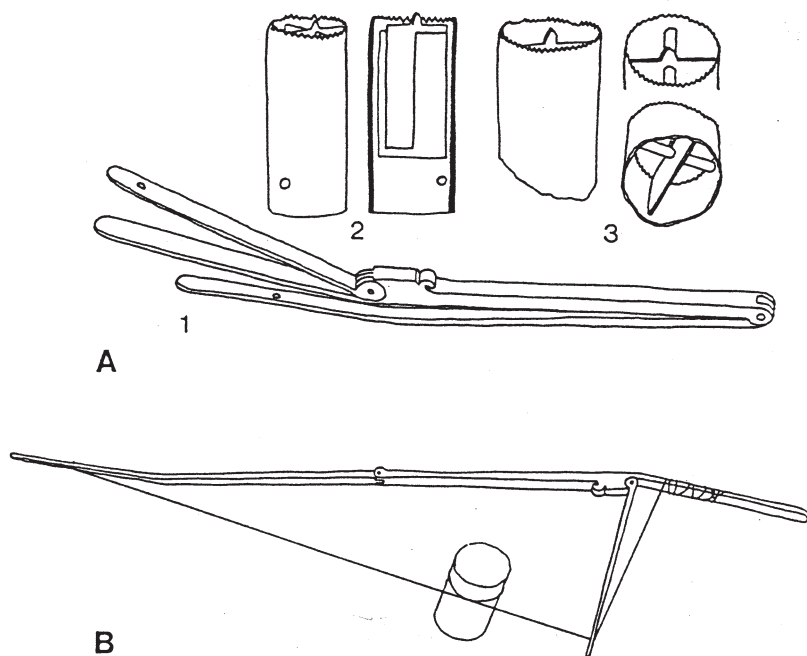


FIGURE 47 *Bow with Crown Drills: Museum am Strom, Bingen-am-Rhein. 1st half 2nd cent. CE.*



FIGURE 48A *Curette: allegedly from Colophon, Johns Hopkins Archaeological Museum, Inv. Buckler 17: L. 19.5 cm. 1st–2nd cent. CE.*



FIGURE 48B *Curette: allegedly from Colophon, Johns Hopkins Archaeological Museum, 1st–2nd cent. CE.*

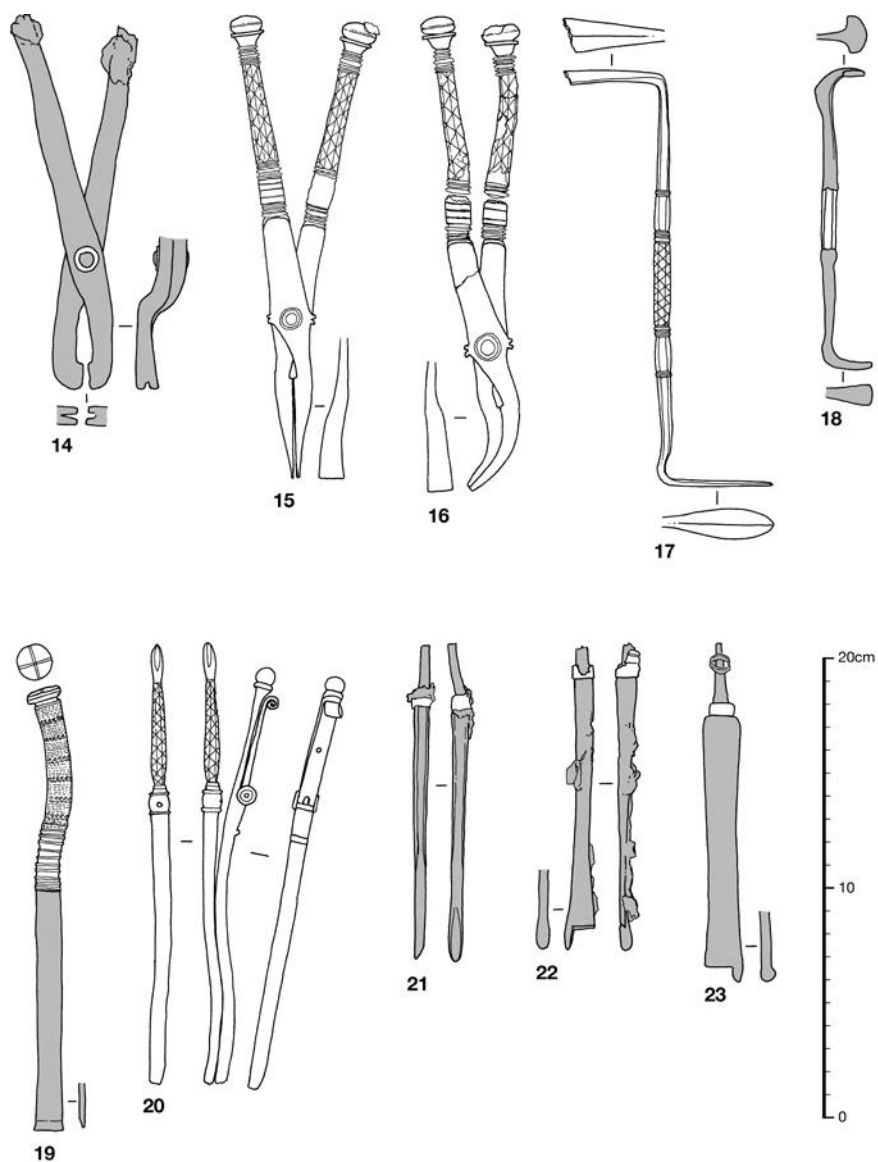


FIGURE 49 *Instruments for Bone Surgery: stump forceps (14), two sequestrum forceps (15–16), blunt retractor probably serving also as guard (17), bone lever (18), chisel handle (19), bow drill (20), gouge (21), lenticulars (22–23). Domus “del chirurgo” at Rimini.*



FIGURE 50 *Bone Levers/Elevators, Pompeii: Nat. Arch. Mus., Naples, Inv. 78012, 78013: L. 18.5–16 cm.*



FIGURE 51 *Handle of Bone Lever/Elevator, Pompeii: Nat. Arch. Mus., Naples, Inv. 77648: L. 8.4 cm.*

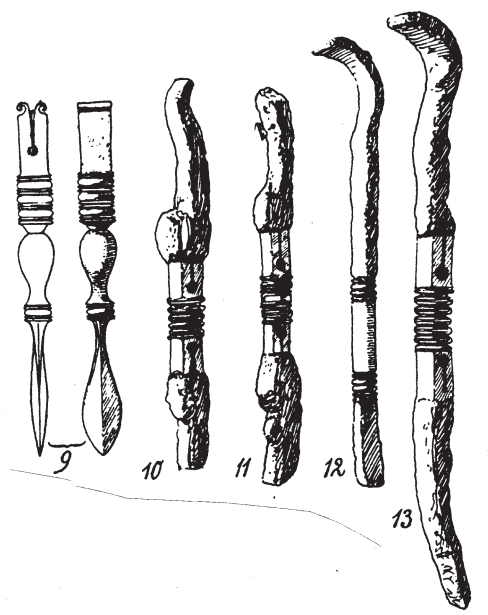


FIGURE 52 *Scalpel Handle and Four Bone Levers/Elevators, Museum am Strom, Bingen-am-Rhein. L. (left–rt.) 10–17.5 cm. 1st half 2nd cent. CE.*

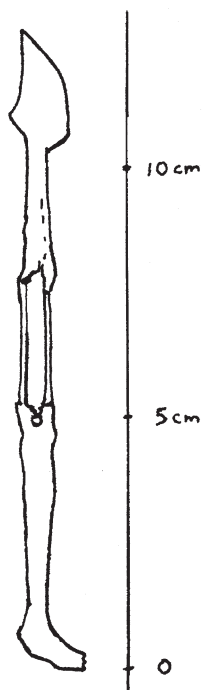


FIGURE 53 *Bone Lever/Elevator, Domus “del chirurgo” at Rimini. 3rd cent. CE.*



FIGURE 54 *Forceps Combined with Bone Lever: Paris, Now in Private Collection. Perhaps 275 CE.*

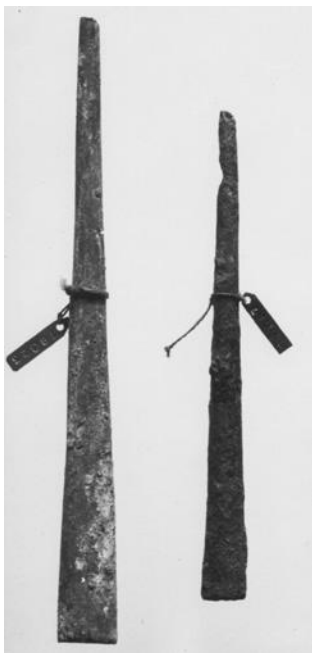


FIGURE 55 *Surgical Tubes, Pompeii: one and probably both from VI 1, 9–10.23 = House of the Surgeon: Nat. Arch. Mus., Naples, Inv. 78023, 78024: L. 17.4 and 13.7 cm.*



FIGURE 56 *Clyster Tubes, Pompeii, the longer from IX 9, 3-5 = Casa del Medico Nuovo (11): Nat. Arch. Mus., Naples, Inv. 116451, 78235: L. 18 and 15 cm.*



FIGURE 57A *Perforated Tube, National Museum of American History (Smithsonian Institution), allegedly from the "Holy Land," Inv. M 10488. L. 9.7 cm.*

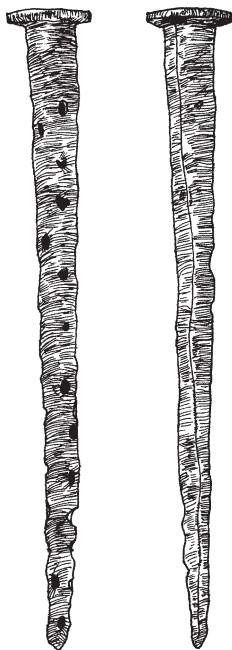


FIGURE 57B *Perforated Tube, National Museum of American History.*



FIGURE 58A *Injection Tube, likely Puoulikos: Nea Paphos, Cyprus, Paphos Museum, Inv. 2548/43. L. 20.2 cm. mid 2nd–early 3rd cent. CE.*

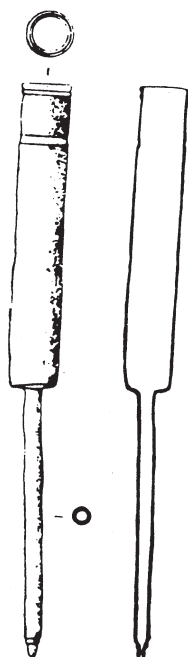


FIGURE 58B *Injection Tube, likely Puoulikos: Nea Paphos.*



FIGURE 59A *Catheter, allegedly from Colophon: Johns Hopkins Archaeological Museum, Inv. Buckler 30. L. 32.2 cm. 1st–2nd cent. CE.*



FIGURE 59B *Detail, Catheter, allegedly from Colophon (showing eye and open seam).*



FIGURE 60 *Cannulae, Pompeii: Nat. Arch. Mus., Naples, Inv. 78008, 78009: L. 12.4, 9.3 cm.*

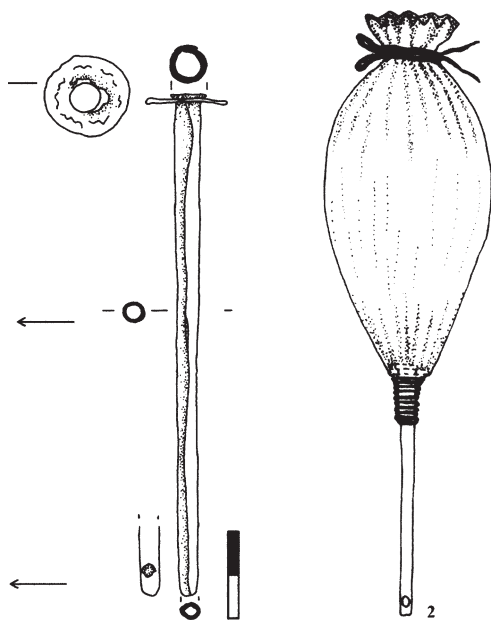


FIGURE 61 *Cannula, Perhaps also Clyster Tube, Alliano, Kat. Nu. 256: L. 11.5 cm. Late 1st to mid. 3rd cent. CE.*

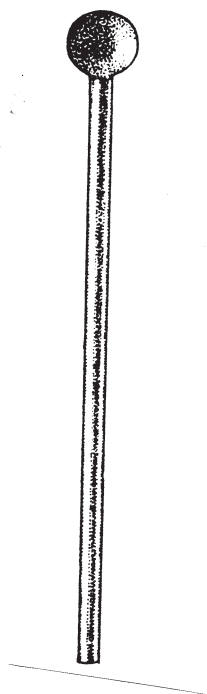


FIGURE 62 *Insufflator, Paris (Lutetia), Paris, Now in Private Collection. L. 15.5 cm. Perhaps 275 CE.*



FIGURE 63 *Bone (Sequestrum) Forceps, allegedly from Colophon, Johns Hopkins Archaeological Museum, Inv. Buckler 24: L. 22 cm. 1st–2nd cent. CE.*



FIGURE 64 *Bone (Sequestrum) Forceps, Pompeii: Nat. Arch. Mus., Naples, Inv. 78029: L. 22 cm.*

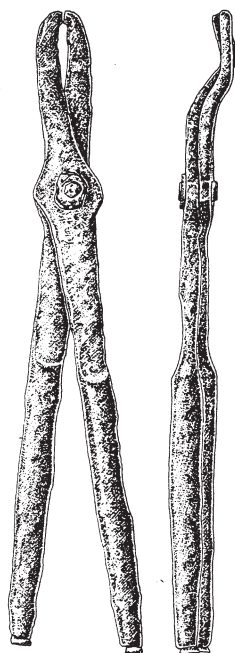


FIGURE 65 *Dental Forceps, Wederath: Trier, Rheinisches Landesmuseum. L. 15,5 cm.*

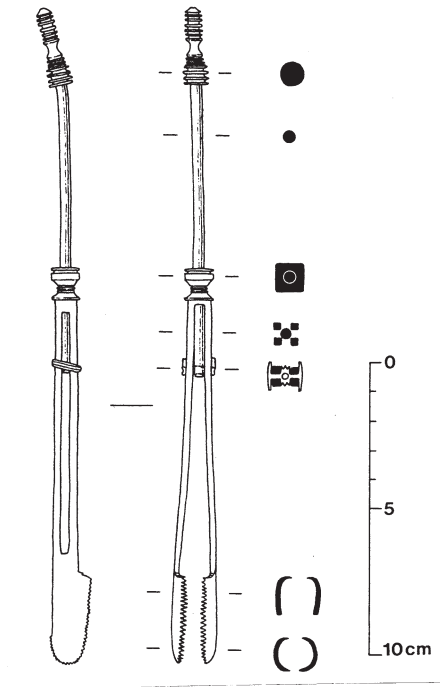


FIGURE 66 *Uvula Forceps with Plunger Handle. British Museum. L. 24 cm.*

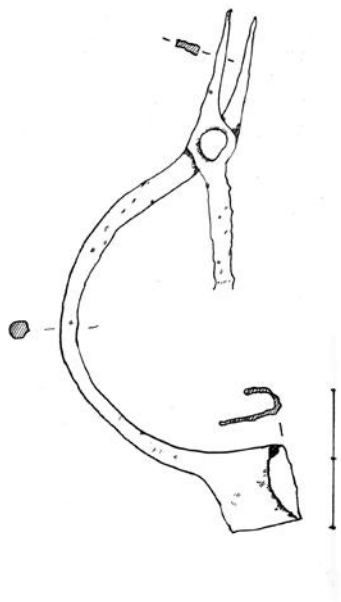


FIGURE 67 *Forceps Type, Proposed as Hemostat: Alliano, Kat. Nu. 297: L. 7.6 cm. Late 1st to mid. 3rd cent. CE.*

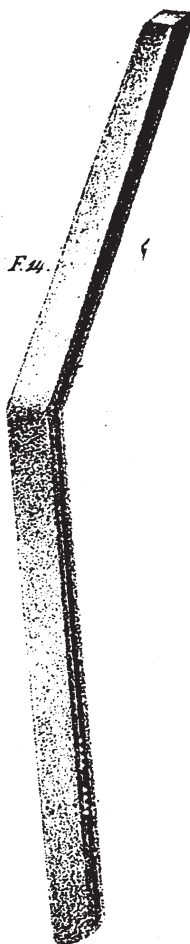


FIGURE 68 *Angled Forceps, Portici.*



FIGURE 69 *Forceps, allegedly from Colophon, Johns Hopkins Archaeological Museum, Inv. Buckler 20: L. 19.5 cm. 1st–2nd cent. CE.*



FIGURE 70A *Quadrivalve Uterine Speculum, Pompeii (Probably VIII 5, 24 = Casa del Medico Nuovo I): Nat. Arch. Mus., Naples, Inv. n3264: L. 31 cm.*



FIGURE 70B *Quadrivalve Uterine Speculum, Pompeii (backside).*



FIGURE 70C *Quadrivalve Uterine Speculum, Pompeii, Detail (worm, crossbar, ram's head).*



FIGURE 71 *Trivalve Uterine Speculum, Pompeii (VIII 3, 10–12 = House of the Medicus A. Pumponius Magonianus): Nat. Arch. Mus., Naples, Inv. 78030: L. 20.7 cm.*



FIGURE 72 *Trivalve Uterine Speculum, Pompeii (IX 9, 3-5 = Casa del Medico Nuovo II): Nat. Arch. Mus., Naples, Inv. 116435: L. 20.5 cm.*



FIGURE 73 *Bivalve Rectal Specula, Pompeii (the larger from IX 9, 3-5 = Casa del Medico Nuovo II): Nat. Arch. Mus., Naples, Inv. 116436, 78031: L. 18 and 15 cm.*

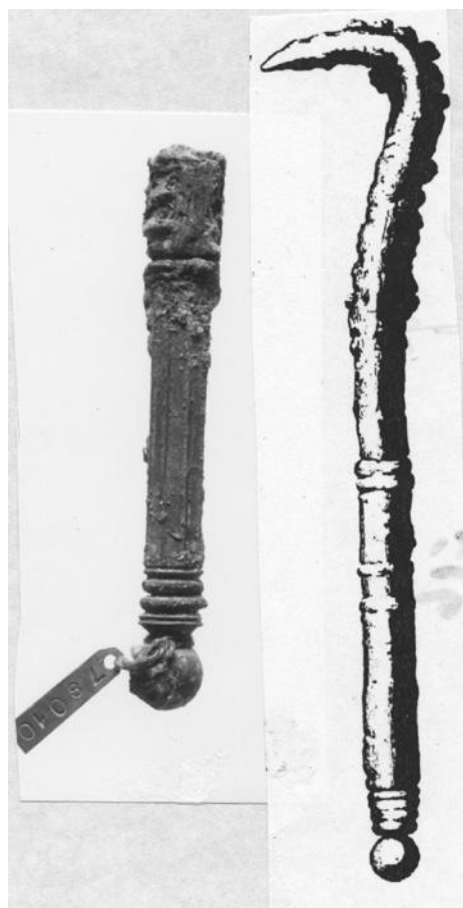


FIGURE 74 *Embryo Hook (current condition and as drawn by Vulpes), Pompeii: Nat. Arch. Mus., Naples, Inv. 78010: Current L. 7.7 cm.*



FIGURE 75 *Embryo Hook/Retractor?* (formerly in Meyer-Steineg Collection in Jena, now missing).

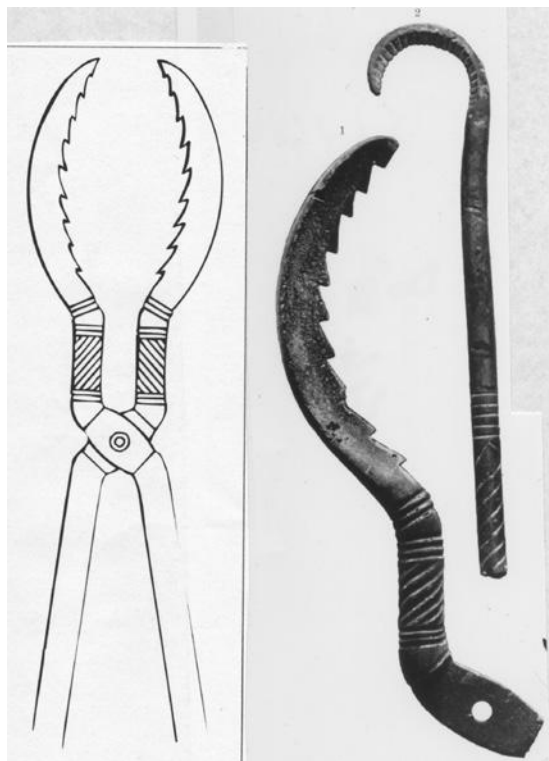


FIGURE 76 *One Element of a Cranioclast (now lost and as restored) and an Embryo and/or Lithotomy Hook. Meyer Steineg Collection, Jena, Friedrich-Schiller-Universität. Institut für Geschichte der Medizin, Naturwissenschaft und Technik (Ernst-Haekel-Haus), Inv. of hook 36: Lengths. 17 and 15,5 cm.*

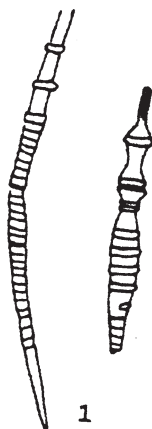


FIGURE 77 *Fragments of Proposed Embruosphaktes, Devnja, Bulgaria (Marcianopolis).*



FIGURE 78 *Birthing Scene Featuring Midwife's Chair. Relief from Tomb of 2nd cent. CE on Isola Sacra, Ostia.*

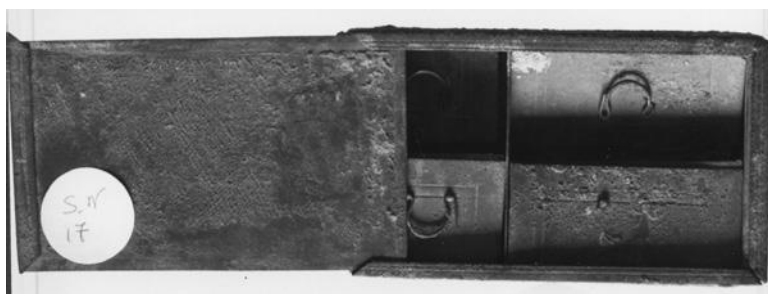


FIGURE 79 *Box for Medicines, Pompeii (V 5, 1-2 = Casa del Medico dei Gladiatori): Nat. Arch. Mus., Naples, Inv. n9883: L. 11, w. 6.4 cm.*



FIGURE 80 *Box for Medicines or Cosmetics, Pompeii (VI 14, 27 = House of M. Memmius Auctus): Nat. Arch. Mus., Naples, Inv. n9740: L. 7.7, w. 5.5 cm.*

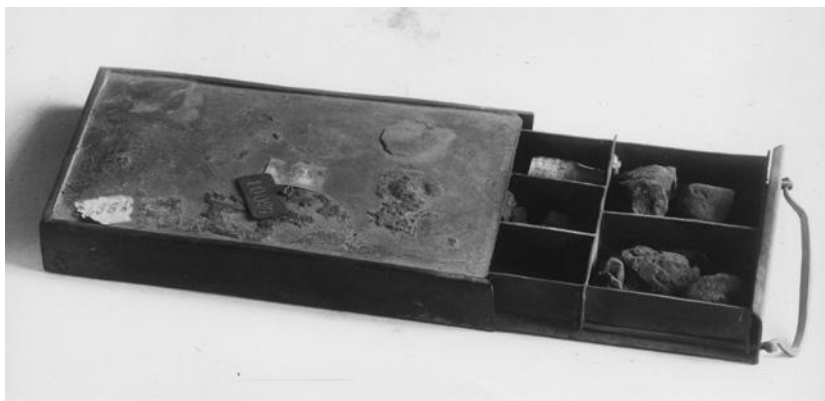


FIGURE 81 *Medicine Box with Pills (now missing), Pompeii: Nat. Arch. Mus., Naples. L. 18, w. 10 cm.*



FIGURE 82 *Medicine Box Dredged from Rhine. Once in Mainz Landesmuseum (Inv. 9529), now "Kriegsverlust." L. 10 cm, W. 8 cm., Ht. 2 cm.*

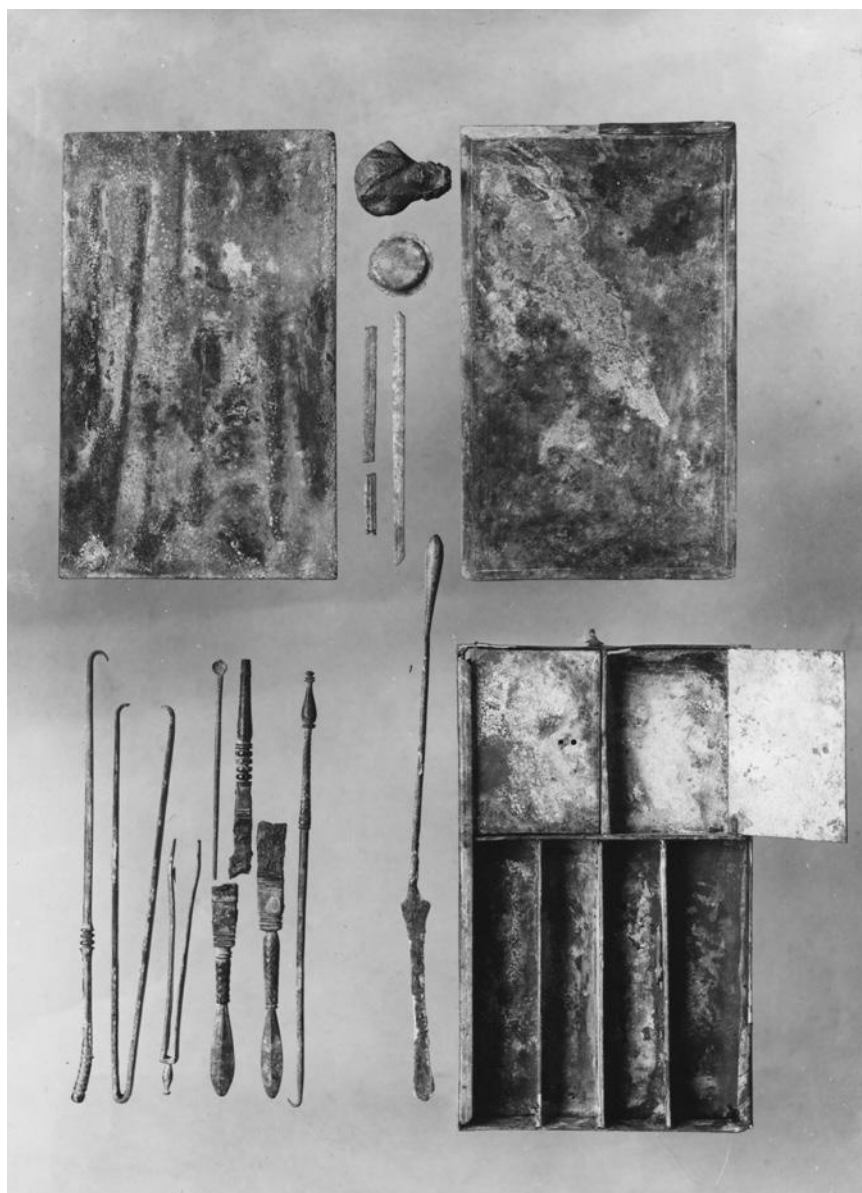


FIGURE 83 *Two-tiered Box from Cyzicus for pills on one level and instruments on the other. The instruments, some of which can be seen as shadows on the underside of the lid (upper left), include: 3 scalpels, 2 sharp retractors (one featuring a needle holder), 2 forceps (the larger dentated), and a small ligula. A spatula probe was independent of the box. The entire ensemble was lost in World War II but the 2 retractors and the 2 forceps have since been recovered. L. of box calculated at 16 cm. based on length of retractor/needle holder (15.4 cm.). Probably late 1st–early 2nd cent. CE.*



FIGURE 84 *Instruments in Cylindrical Carrying Case (which lacks its cover), Pompeii (IX 9, 3-5 = Casa del Medico Nuovo II): Nat. Arch. Mus., Naples, Inv. 116444, 116444A-G: L. of spatula 19.7 cm.*

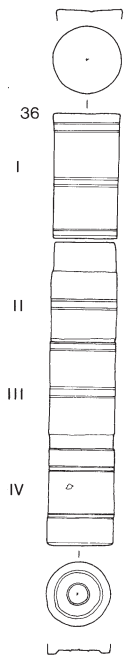


FIGURE 85 *Segmented Cylindrical Case, Italy; British Museum: Ht. 21.4 cm. 1st–early 2nd century CE.*



FIGURE 86 *Grave Furnishings, Cologne, including: a clay bowl, two small greenish glass containers, a small case (Hülse), a bright (helles) glass bowl and a small cask (Fässchen), LVR-LandesMuseum Bonn, Inv. 3689, 3669, 3668, 3678, 3671, 3673. 2nd–4th cent. CE.*

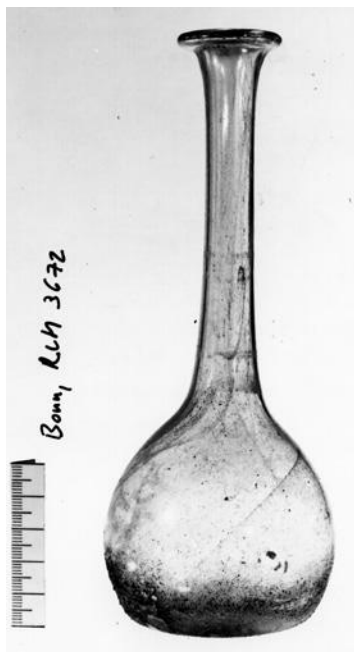


FIGURE 87 *Bright Glass Container (Balsamarium), Cologne, LVR-LandesMuseum Bonn Inv. 3672. 3rd–4th cent. CE.*



FIGURE 88 *Ash Urn, Rheims: Musée de l'Histoire de la Médecine, Paris.*



FIGURE 89 *Glass and Other Containers and Instruments, including scalpels, retractors, needles and shears: Nijmegen/Noviomagus, Leiden, Rijksmuseum van Oudheden. 3rd cent. CE.*

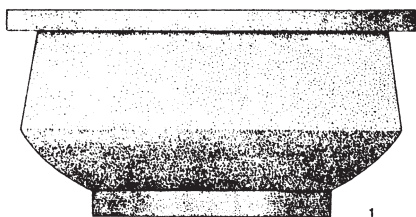


FIGURE 90 *Bronze Kettle, Paris (Lutetia): Private Collection, Paris. Perhaps 275 CE. Ht. 11 cm, Max. W 20 cm.*

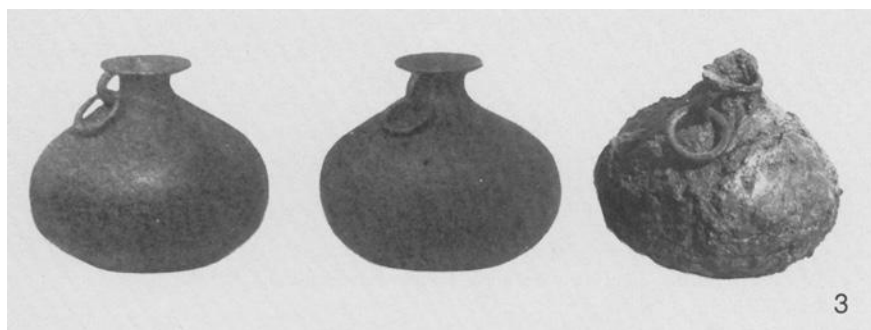


FIGURE 91 *Iron medicine pot (accompanied by two reproductions): Gaius Firmius Severus Instrumentarium, Rheims: Musée d'Archéologie nationale, Saint-Germain-en-Laye. Ht. 7.5 cm. Late 2nd–early 3rd century CE.*



FIGURE 92 *Scale/Balance: Johns Hopkins Archaeological Museum, Inv. Buckler 2: L. of beam 30 cm. 1st–2nd cent. CE.*

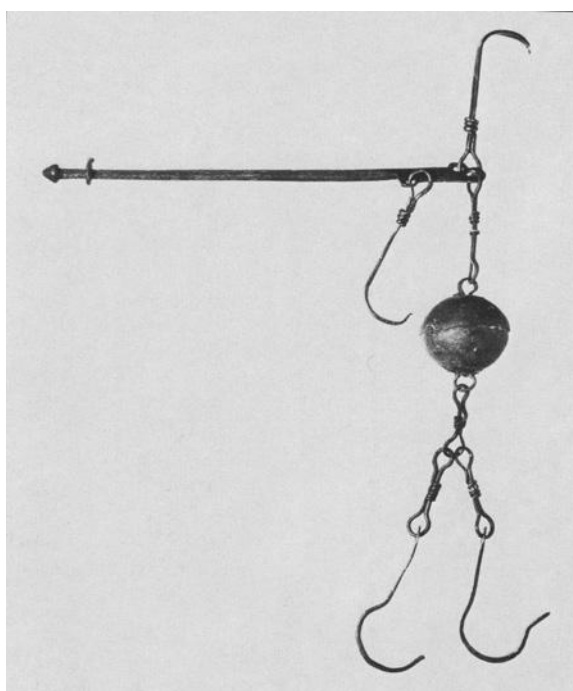


FIGURE 93 *Steelyard: Gaius Firmius Severus Instrumentarium, Rheims: Musée d'Archéologie nationale, Saint-Germain-en-Laye. L. of beam 27.5 cm. Late 2nd–early 3rd century CE.*

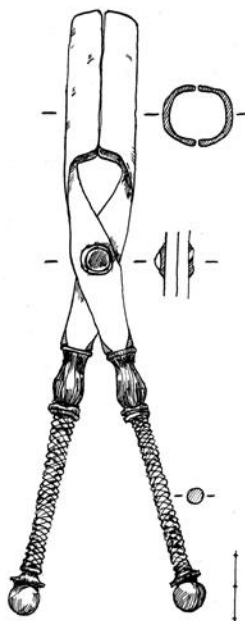


FIGURE 94 *Forceps?: Allianoi. L. 20.3 cm. Late 1st to mid. 3rd cent. CE.*



FIGURE 95 *Iapyx Treats Wounded Aeneas, Naples Museum (from House of Siricius, Pompeii).*